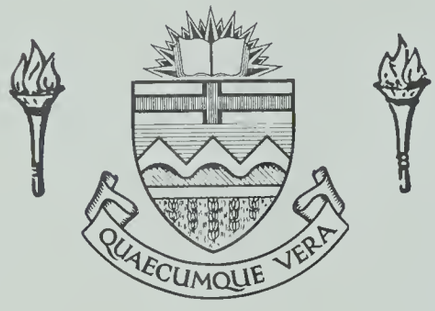

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SOME CORRELATES OF COGNITIVE COMPLEXITY

by

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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Some Correlates of Cognitive Complexity" submitted by Gareth Smith Gardiner in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

From a general theoretical position that cognitive complexity is an important construct having implications for education in a contemporary society, it was further suggested that a satisfactory test battery to measure cognitive complexity has not been established.

Accordingly, the main hypothesis tested was that a number of measures and postulated measures of cognitive complexity would load significantly on a factor representative of complexity.

Results of the factor analyses lent tentative support to this hypothesis, and a first step toward the establishment of a test battery was taken by correlating test items with complexity factor scores obtained by the subjects.

Minor hypotheses that firstborn subjects and indiscriminately pro-religious subjects would exhibit relative cognitive simplicity were disconfirmed, although mitigating circumstances significantly affected the latter finding. Girls were found to be significantly more cognitively complex than boys, and an interpretation of this finding was offered.

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CHAPTER I

INTRODUCTION

Cognitive complexity is an inferred structural construct considered by Schroder, Driver and Streufert (1967) to consist of two components: (a) the number of dimensions used for interpreting input, and (b) the schemata (integrative rules) governing the relations among dimensions.[1] This definition, superficially at odds with those appearing in Harvey (1966), Hunt and Dopyera (1966), and Harvey, Hunt and Schroder (1961), has apparently been influenced by Shepard, Hovland and Jenkins (1961) and Shepard and Chang (1963), for Schroder et al. (1967) remark that in the measurement of differentiation, multi-dimensional scaling (MDS) is a technique having a great deal of promise. This procedure is designed to eliminate overlapping or identical categories which the subject may use in handling stimuli. "In this method the subject makes similarity judgements between all pairs of the stimuli involved. The analysis then consists of calculating the number of dimensions required to reproduce the judgement matrix (Schroder et al., 1967, p. 24)." Schroder and his co-

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[1]Other authors' definitions are similar. Crockett (1965, p. 49) contends that a cognitive system may be considered complex when (a) it contains many elements, and (b) when they are integrated to a relatively high degree. Harvey (1966) considers integrative complexity to be an essential condition of cognitive complexity, as does Tuckman (1966).

authors suggest as well that the only operational method available at the present time for direct measurement of integrative rules is MDS, and they offer a rationale for its use in this context (ibid., pp. 180-184). Driver (1962) used MDS to measure integration in an inter-nation simulation study, but the method is too cumbersome to include in a test battery of the type used in the present investigation, and has been confined to relatively small samples.

Terms like "integration", "hierarchical", and "concrete-abstract" can readily be made compatible, however, under the assumption that the first two refer to behavioral effects or outcomes, while the latter two define underlying psychological processes. This is not quite so unlikely as it seems. Consider the case of Inhelder and Piaget (1964, pp. 11-107) where a hierarchy of effects can be demonstrated which is clearly based on a psychological process of rising abstraction. Consequently, when Schroder et al. (1967) talk about low integration and high integration, it is assumed in this study that for psychological purposes they are referring to concrete or abstract groups of individuals. The development of increasing abstractness can be illustrated by referring to a description by Inhelder and Piaget (1964) of sequential and hierarchical rule learning by the child. A dominant emphasis in Piaget's work has been the investigation of the orderly sequences

by which the child establishes and manipulates the logic of classes and operations (concrete operations) on the basis of which the more abstract formal operations of propositional logic are built at a higher and later stage of development. The early elementary-school years are characterized by a type of pre-classificatory behavior called the stage of graphic collections (ibid., p. 19), in which the child groups objects on the basis of simple associationistic notions of "belonging together", and ultimately forms, not a class, but a story or object. For example, he might group a number of rectangles to form a "train" (ibid., pp. 17-46). This behavior, which is tied to concrete (empirical) reality, eventually gives way through a series of intermediate stages, to a more complex (abstract) form of classification.

Consider, for example, the following protocol by Chen (8 years, 6 months), who is working with geometrical shapes and letters:

> Chen (8; 6) with the same materials, makes up three large classes: the rectangles and squares (forming two subclasses), the circles (subdivided into large and small) and the letters (subdivided according to the different kinds) (ibid., p. 54).

Chen shows evidence of developing a plan or "anticipatory schema" before beginning the classification task. The

results of his work may be diagrammed[2] thus:

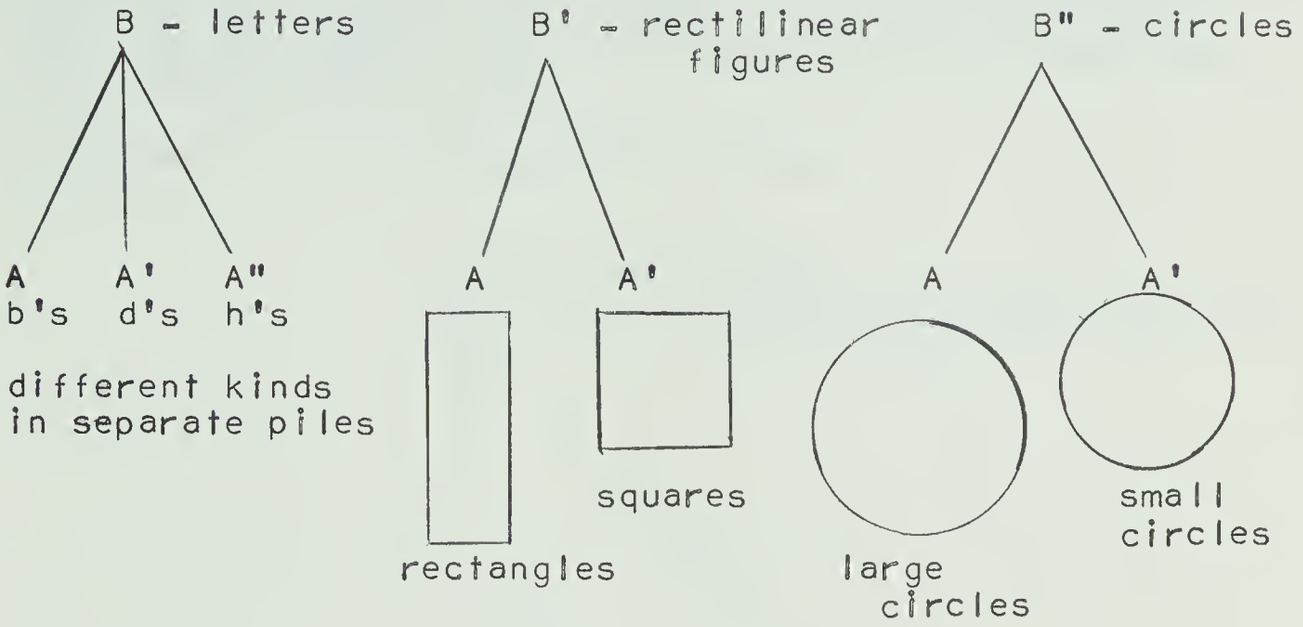

Figure 1 -- Classification: Criterion Shape, Linear Order

The large collections are devised on a trial-and-error basis, and are spatially adjacent ("juxtaposed"). Chen seems to have an intuitive grasp of class inclusion; namely, that B is greater than A and includes A, but he is apparently not aware of the inverse relation: that A = B - A' (Inhelder and Piaget, 1964, p. 54), and hence has not conquered the logic of relations.

Consider, at the next developmental stage, Rob's protocol:

Rob (8; 2), given the materials . . . , starts with four classes: (a) the circles, semi-circles, and sectors, (b)

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[2]This diagram is adapted from Rawson (1965, p. 47).

the triangles, (c) the squares and (d) the rings. Then he unites (b) and (c), saying "all the squares and triangles", (i.e., rectilinear shapes, but he keeps them separate in the one box) and (a) and (d), "all the rounds" (=curvilinear forms) which are also subdivided according to variety (ibid., p. 55).

A diagram[3] of his arrangement follows:

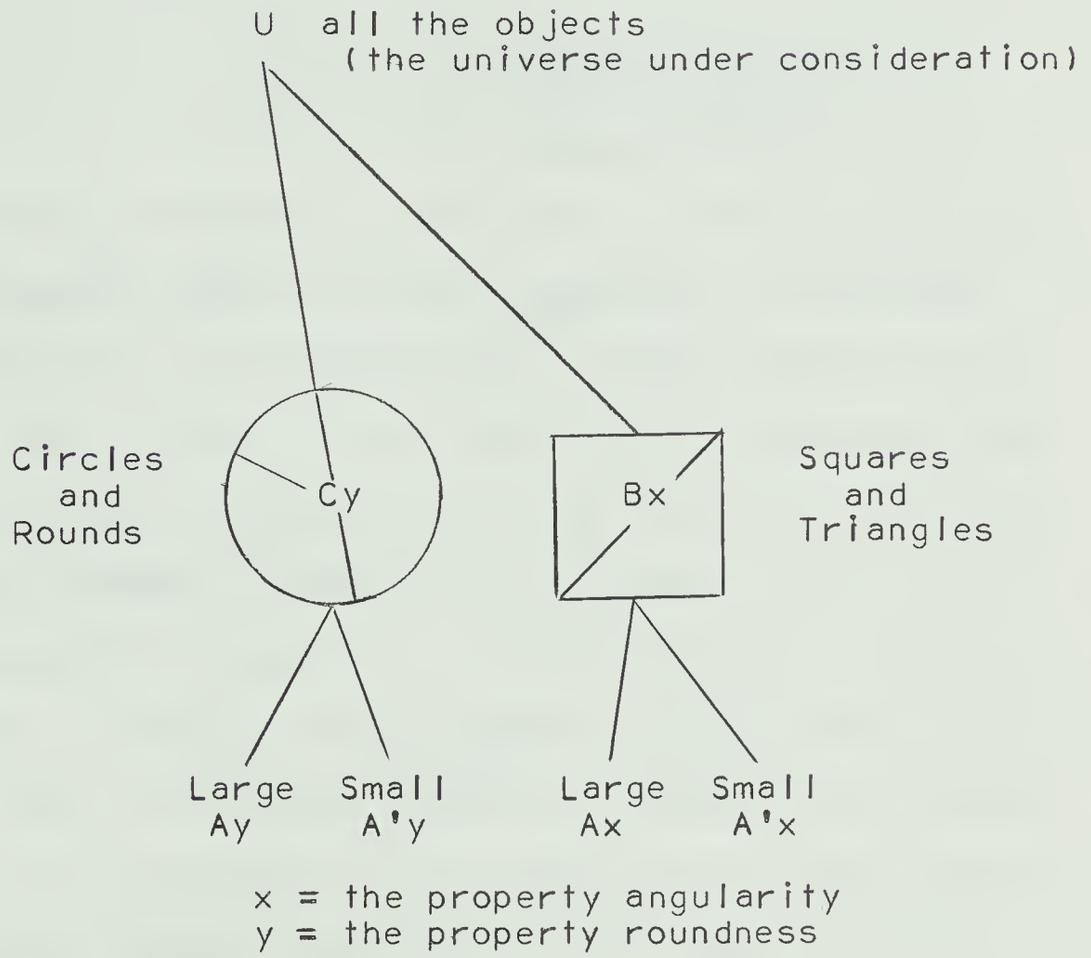

Figure 2 -- Classification: Criteria Shape and Size, Hierarchical Order

This type of schema may (but not necessarily) permit the child to become aware of a "necessary inverse operation" (e.g., the big rounds are all the rounds except the

[3]Adapted from Rawson (1965, p. 49)

little ones. A' = C - A). In this example, Rob appears to have grasped the fact that the universe class is made up of squares and circles:

$$U = B + C$$

And that:

$$B = A + A' \text{ (with property 'x' in common with B)}$$
$$C = A + A' \text{ (with property 'y' in common with C)}$$

The child's performance is still at the level of collections, however, since he cannot quantify the relationships involved in his hierarchical system (Inhelder and Piaget, 1964, p. 55). True classification involves both listing all the members of the class (its extension) and naming the property shared by every member of the class (its intensional property). In Piaget's view, the child must learn to assign correct meanings to the words "all", "some", "one", and "none" before he reaches such a stage.

In an experiment with flowers, Per learns the relationship of "some" to "all", and thus makes a significant advance in rule-learning:

Per (8; 3) has already constructed three classes: yellow primulas, primulas and flowers. "Can one put a primula in the box of flowers (without changing the label)?--Yes, a primula is also a flower.--Can I put one of these flowers, say a tulip, in the box of primulas?--Yes, it's a flower like the primula." When the experimenter does so, she changes her mind, and puts it back with the other flowers. "Can one make a bigger bunch with all the flowers or with all the primulas?--It's the same thing. Primulas are flowers, aren't they?--Suppose I pick all the primulas, will there be any flowers left?--Oh yes,

there will still be violets, tulips and the other flowers.--Well, suppose I pick all the flowers, will there be any primulas left?--No, primulas are flowers. You're picking them too.--Are there more flowers or more primulas?--The same number. Primulas are flowers.--Count the primulas.--Four.--And the flowers?--Seven.--Are there the same number?--(Astonished.)--The flowers are more . . ." (Inhelder and Piaget, 1964, p. 107).

The available classifications of the flowers (four primulas and three other flowers) used in this protocol are diagrammed[4] as follows:

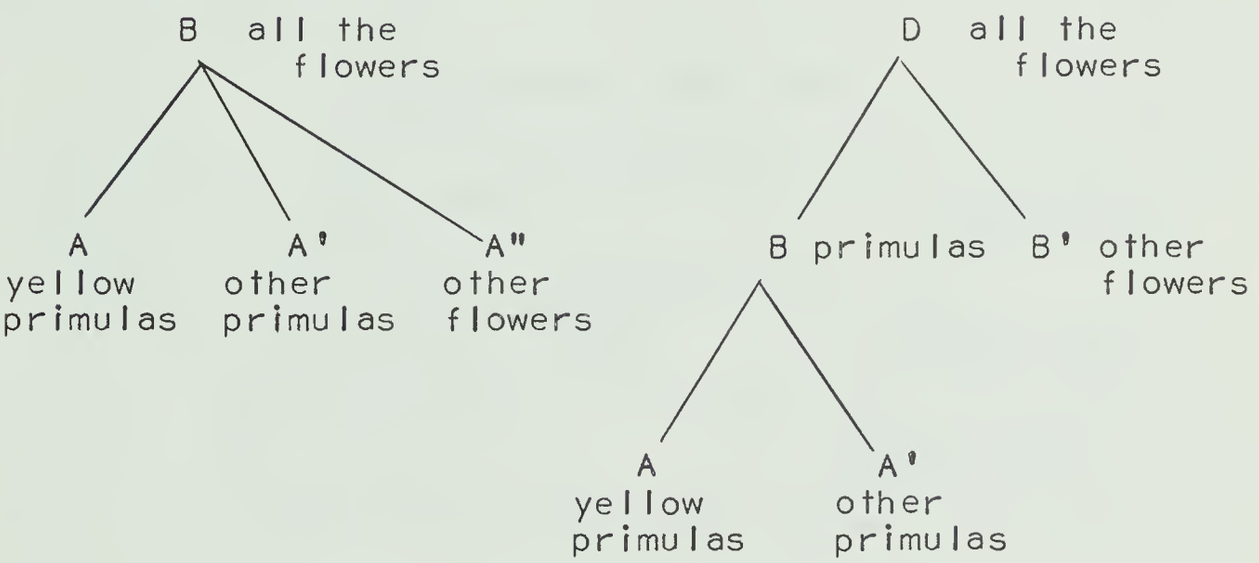

Figure 3 -- Classification: Hierarchical Order, Class Inclusion Relations

Inhelder and Piaget observe that children over eight years of age become increasingly able to produce hierarchical orderings, recognizing additive groupings and quantitative relationships within the hierarchy (i.e., grasp the logic of classifications). In some way they

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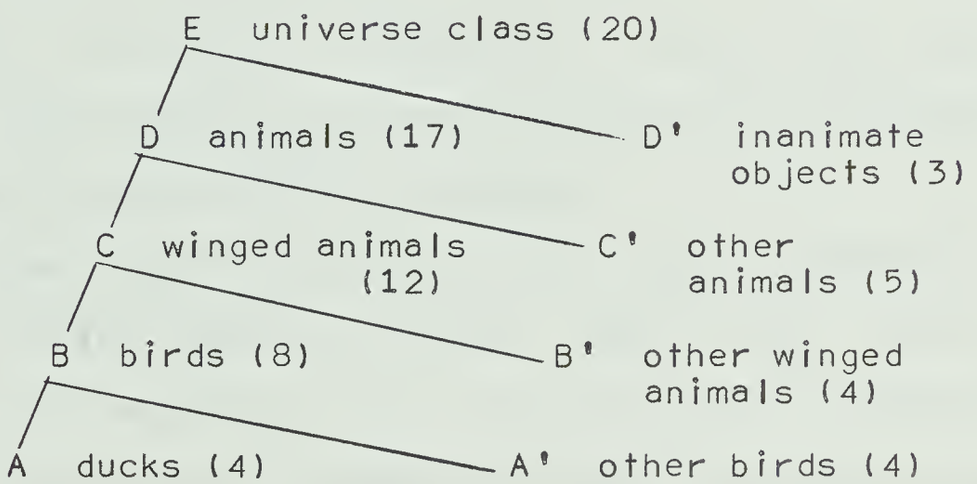
[4]This diagram is adapted from Rawson (1965, p. 54).

learn to hold or fixate the superordinate class, and quantify the relationship between the subordinate and superordinate classes.

In a similar study, using printed pictures of a variety of birds and animals, Inhelder and Piaget (1964, pp. 110-116) asked children to classify the pictures. Three pictures of inanimate objects were also included. The correct classification scheme is presented in the following diagram:[5]



(the numbers in brackets indicate the number of objects in each category)

Figure 4 -- Classification: Quantification of Classes, Hierarchical Order, Less Familiar Objects

Since animals are somewhat beyond the concrete experience or grasp of children, they typically experience more difficulty with this type of task than they do with flower-sorting tasks. Nov (11; 5), however, over-

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[5]This diagram is adapted from Rawson (1965, p. 57).

comes initial difficulty to achieve a correctly quantified classification:

> Nov . . . classes series II into non-living (D') and living things (D), and then into animals that do not fly (C') and animals that do (C), and then into insects (B') and birds (B), the birds being subdivided into ducks (A) and others (A'). He agrees to remove the partition between A and B, to give all the birds, etc. "Are there more birds in these boxes, or more ducks?--More birds.--Are there more animals that fly or more birds?--(He looks at the numbers in B and B'.) They're the same.--(The question is repeated.)--Oh, no! There are more animals that fly, because birds are animals that fly." (Inhelder and Piaget, 1964, p. 115).

Although these examples are very limited in scope, they do illustrate the concept of sequential simple (concrete)-to-complex rule learning, and the progressive chronological emergence of more abstract schemata.

Now it is fairly clear that, despite Piaget's protests to the contrary (Piaget, 1950, p. 27), the development he describes is of a logical, not a psychological, sort. If attention is placed on Piaget's sequence as one running from concrete to abstract (formal) operations (Piaget, 1950; Piaget, 1957, pp. 8-22), then a sequential psychological formulation functionally associated with the logical development would be Harvey's (1966) recent comprehensive account of the development of cognitive systems from simplicity and concreteness to complexity and abstractness. One of his major contentions is that in "the progressive development from a state of conceptual undifferentiation to differentiation and integration, from greater concreteness to greater abstractness, the con-

ceptual system tends to pass through certain plateaus or stages of varying time and breadth (Harvey, 1966, p. 43)." He identifies four nodal points on the continuum between extreme concreteness and abstractness.

At the concrete end, SYSTEM 1 functioning is characterized by such behaviors as high absolutism and closedness, high positive dependence on authority, high social identification and conventionality, and strong ethnocentrism. This most concrete mode of functioning is the result of a training environment

> in which the developing individual has been restricted in exploration of his environment, especially that part of his world concerned with values and power relationships. Along with minimal exposure to diversity in relation to social norms, the trainee's rewards and punishments are contingent upon his idea and approaches to problems conforming to the omnipotently and omnisciently imposed standards of the training agent (ibid., p. 44).

SYSTEM 2 functioning lies a step above System 1 in abstractness, and results from "capricious and arbitrary child-rearing practices which, owing to failure to provide any stable or predictable referent points in an unstructured world, presents the developing child with diversity far in excess of the optimal (ibid., p. 45)." This type of environment may produce a limited amount of differentiation, but it also leaves the individual with deep feelings of uncertainty, distrust and rejection while failing to provide suitable guides for action. "System 2 representatives . . . seem to be in a psy-

chological vacuum, guided more by rebellion against social prescriptions than by positive adherence to personally derived standards (Harvey, 1966, p. 45)."

Although it results from childhood over-protection and over-indulgence, SYSTEM 3 functioning is still higher in abstractness. The child develops fairly high cognitive skills through manipulation of his parents, but these techniques are oriented toward the establishment of dependency relationships upon others. The System 3 representative develops some autonomous personal standards and fairly positive ties to the prevailing social norms, but he is basically incapable of functioning in an independent manner.

SYSTEM 4 functioning is at the most abstract end of the continuum and is regarded as being the consequence of a training background marked by freedom not only to explore the physical and social environments, but also to establish values based on one's own experience, and to solve problems independently, without fear of punishment. "The System 4 representative, who is the recipient of diversity along with stability as a developing child . . . comes to have a highly differentiated cognitive structure and consequently to be more flexible, more creative and more relative in thought and action (ibid., pp. 45-46)."

Schroder and Harvey measure cognitive complexity by concentrating on the intellectual features of the first

and last categories, leaving alone the two intermediate[6] categories, which are based largely on social characteristics. There are good theoretical (Goodman, 1966; Anderson, 1968) and empirical (Joyce, Lamb and Sibol, 1966; Sieber and Lanzetta, 1966; Harvey, Prather, White and Hoffmeister, 1968) reasons why the psychometric consideration of this complexity dimension should be of interest to the educator. Consider, first, the theoretical reasons.

Anderson (1968) has pointed out the necessity of investigating and using the complexity construct in his elucidation of the psychological implications of Galbraith's (1967) important book. In this work, Galbraith contends that the increasingly corporate nature of contemporary North American society has ominous overtones for individual autonomy. The complexity and enormity of the modern corporation have led to the decline of the traditional entrepreneur and entrepreneurial skills: corporate planning is increasingly carried out by a technostructure, or hierarchy of technical and executive personnel, which achieves decision by pooling specialized, independent information. The technostructure is dedicated primarily to the maximization of the earnings of the corporation and the preservation of its autonomy. One of the most important means of achieving these goals is to manipulate consumer demand. Thus, a major effort is made "to shift the locus of decision in the purchase of goods

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[6]Hunt and Joyce's (1967) use of the intermediate categories has contributed little or nothing to conceptual systems theory or practice.

from the consumer where it is beyond control to the firm where it is subject to control (Galbraith, 1967, p. 205)." In short, Galbraith's thesis is that individual decision making is undergoing a systematic devaluation both within and without corporate walls.

Anderson (1968) claims that reviewers of the book have largely ignored its educational implications: namely, that it is in the interest of the corporation that the consumer be a compliant, conforming, cognitively simple (few dimensions, simply related) sort of person who is easy prey for the emphases and distortions of corporations and their slaves, the advertising agencies. "Such an individual is at the mercy of the stimulus, easy game for the advertising agencies (Anderson, 1968, p. 11)." He outlines in distressing detail the increasing influence that corporations are coming to have over educational media (witness the purchase of publishing houses by corporate giants), and points to an impressive body of evidence indicating that "all sorts of accommodative behavior are valued by the school; social adroitness, a reliance on external criteria for judging people, a willingness to get along (with) . . . established authority . . . , and a rejection of discrimination which reflects private standards of what is valuable (ibid., p. 9)." He suggests that this progressive mechanization of individuals may be offset, rather than augmented, by education, and indicates that conceptual systems theory

may be a source of assistance.

If specifically educational agencies were able to produce relatively large numbers of cognitively complex (many dimensions, complexly related) persons through provision of training environments of the type described by Schroder et al. (1967, pp. 45-53) and Harvey (1966, pp. 61-63), these individuals would stand a better chance of retaining autonomy and integrity in a society where various levels of authority and socializing agencies implicitly assume that the populace is cognitively simple, and possibly ready to register and accept their rules of behavior. Goodman (1966) has eloquently commented upon this situation.

> For the genius of our centralized bureaucracies has been, as they interlock, to form a mutually accrediting establishment of decision-makers, with common interests and a common style that nullify the diversity of pluralism. Conflict becomes coalition, harmony becomes consensus, and the social machine runs with no check at all. In the major decisions that are made by the interlocking decision-makers, the democratic representation of the ordinary person is "virtual" rather than actual, as with the American colonists in the British Parliament (1966, pp. 77-78).

How is the individual citizen to reestablish a role in contemporary "democratic" society? Goodman advocates a type of pluralism (as opposed to centralism) in which "it must try to increase class consciousness, craft pride, professional autonomy, faculty power in the universities, co-operative enterprise, local patriotism, and rural

reconstruction (ibid., p. 79)." He also points out that this form of pluralism will inevitably involve conflict, and views student disorders in this context. Such a life style would necessitate a citizenry possessing high-order conceptual skills.

The cognitively-complex individual is uniquely equipped to cope with an environment full of conflict and uncertainty, for he is flexible, creative and relative in thought and action, and employs internal standards that are comparatively independent of external standards such as conventional social definitions (Harvey, 1966, p. 46). Watson (1968) provides a vivid illustration of this type of high-conceptual level behavior in real life when he describes the antics of his friend, Francis Crick, who with Watson and Wilkins discovered the structure of the DNA molecule.

> I have never seen Francis Crick in a modest mood. Although some of his closest colleagues realized the value of his quick, penetrating mind and frequently sought his advice, he was not often appreciated and most people thought he talked too much. Often he came up with something (theoretically) novel, would become enormously excited, and immediately tell it to anyone who would listen. A day or so later he would often realize that his theory did not work and return to experiments, until boredom generated a new attack on theory. Anything important would attract him, and he frequently visited other labs to see which new experiments had been done. Almost immediately he would suggest a rash of new experiments . . . . The quick manner in which he seized their facts and tried to reduce them to coherent patterns frequently made his friends' stomachs sink with apprehension . . . (Watson, 1968, pp. 7-10).

Stager (1967) has found that when a decision-making group is composed largely of high conceptual level

(cognitively complex) members, there is an increase in role flexibility and thus a considerable amount of functional role uncertainty. This is because "theoretically, high conceptual level members are able to cope with a higher level of uncertainty in their environment and are more adaptable to environmental demands than low conceptual level members (Stager, 1967, p. 153)." The high conceptual level group typically generates a substantial degree of interpersonal conflict, but this is due to extensive evaluation of alternative courses of action. Such a group spends a great deal of time searching for novel information; and, when it reaches a decision, does so on the basis of rational consideration of alternatives. The low conceptual level group, in striking contrast, develops a hierarchical group structure which minimizes role uncertainty and extensive generation or evaluation of divergent alternatives. The decision-making function is marked more by compulsivity than by rationality (ibid., p. 155). Clearly a society concerned with the preservation of effective democratic processes would do well to encourage a maximum amount of high conceptual level group functioning.

The empirical evidence indicates that high-level functioning is a critical variable affecting teacher efficiency. Joyce, Lamb and Sibol (1966) compared some of the ways in which teachers of highly concrete and

highly abstract conceptual structure handle information about children. Each subject's conceptual level was assessed on the basis of a composite score derived from the Schroder PCT, the Impression Formation Test, and the Situation Interpretation Test, with the top and bottom 27 percent of the sample selected to serve in the study. These subjects were then asked to respond to remedial and diagnostic statements which followed each of three passages of behavioral information about a child. New information was given with each new passage.

After one passage had been read, the abstract subjects were less positive than the concrete subjects about both diagnostic and remedial statements, but by the time the third passage had been read abstracts were slightly more confident than concretes in response to diagnostic statements and significantly (.001) more confident in response to remedial statements (Joyce et al., 1966, p. 221). "Clearly the abstract subjects took more definite positions as they received more information about the case while concrete subjects did not become more certain as they received more information . . . (ibid., p. 221)." The concrete teacher, possessing few informational dimensions and relatively simple integrative rules, cannot effectively utilize information about students while the abstract teacher integrates and uses additional input to benefit the student. The authors comment that researchers have long been puzzled by the ineffectuality of psychol-

ogy courses in improving teachers' ability to make effective decisions when presented with behavioral data, and contend that this phenomenon may well be a function of widespread cognitive simplicity among teacher trainees (Joyce et al., 1966, pp. 221-222).

Harvey et al. (1968) found that abstract teachers, when rated by students, were significantly more resourceful, less dictatorial and less punitive than concrete teachers. The students of abstract teachers were more involved, more active, higher in achievement and more abstract than were students of concrete teachers. An interesting aspect of the study was the fact that the authors could identify only 18 clear cases of System 4 teachers, or six percent of the sample, and were forced to use less than ideal cases in their abstract sample. These researchers comment, however, that this percentage is almost identical to the seven percent of System 4 individuals found among 3000 undergraduates of all faculties. The teaching profession, however, does not suffer from a surplus of cognitively-complex pedagogues.

With reference to decision-making, Sieber and Lanzetta (1964) found that cognitively-complex persons sought more information and took more time before reaching decisions than did cognitively-simple individuals. The complex persons were also less certain in their decisions but gave relatively more facts concerning decision problems and more inferred information relevant to

the problem. In a complementary study, Sieber (1964) found that simple and complex teachers exhibited much the same decision-making characteristics as these.

With this evidence in hand, Sieber and Lanzetta (1966) studied the process variables underlying these structural differences. In the first phase of their investigation, they hypothesized that complex persons would generate more response alternatives in a decision task, report greater subjective uncertainty, differentiate more aspects of the problems, and generate more controlled associates to these aspects than would simple persons. They report that

> subjects were asked to observe some difficult stimuli and report what stimulus characteristics had been noticed and what inferences had been made about the stimulus. Analyses of variance revealed that structurally complex subjects produced significantly more characteristics ($df = 1, 16, F = 9.86, p < .01$) and significantly more inferences ($df = 1, 16, F = 13.2, p < .005$) than structurally simple subjects as predicted (Sieber and Lanzetta, 1966, p. 567).

In the important second phase of their study, they gave simple and complex subjects two kinds of complexity training. In uncertainty training (ibid., p. 565), subjects were trained to generate many guesses as to the identity of stimulus objects presented in tachistoscopically presented slides, following Maltzman's (1960) originality training technique. Subjects undergoing mediation training (ibid., p. 566) were verbally reinforced for noticing a variety of details on

slides presented for 1/100 of a second. They were then reinforced for any hypotheses they generated about the content of the slides. The trained subjects' performance on a decisions task was compared with that of an untrained control group.

Results showed that "both procedures generally increased the complexity of information processing as predicted . . . (ibid., p. 568)." The amount of information search, number of uncertainty statements, amount of additional information given with decisions, number of correct responses and time taken per query all increased with training.

With respect to information search, there was a training X conceptual structure interaction as predicted, in which structurally simple subjects learned to behave like complex subjects following uncertainty and mediation training, but complex subjects remained relatively unchanged by training. This interaction did not occur with the other dependent variables; following uncertainty or mediation training both complex and simple subjects increased the amount of information given with their decisions and their number of statements of subjective uncertainty; training increased the information-output level of structurally simple subjects beyond the control output level of complex subjects, and the trained complex subjects increased their responding beyond the control complex level following training (ibid., p. 568).

Clearly what is wanted is some evidence that the various tests which purport to measure complexity (Harvey's, Schroder's, Tuckman's, and so forth) do indeed intercorrelate significantly enough to define a factor which can without verbal solipsism be labelled

cognitive complexity. Reviews of the research on complexity have indicated either a marked lack of agreement among instruments purporting to measure it, or a disinterest in examining the relationships among tests which might be significantly related[7] (Bieri, 1966; Scott, 1963; Vannoy, 1964).

In his factor-analytic study, Vannoy (1964) used a battery of thirteen tests designed to measure cognitive complexity and its correlates. The sample used, however, was a group of freshmen college males. The analysis of the intercorrelational matrix was done using the principal axes method, and eight factors were extracted and rotated to simple structure by the Varimax method. His interpretation of the factors suggested that cognitive complexity reflects three broad behavioral tendencies: the tendency to emphasize many as opposed to few judgemental dimensions, the tendency to use many as opposed to few positions on the various judgemental dimensions, and the tendency to maintain a broad and flexible perspective as opposed to a narrow and rigid one (Vannoy, 1964, p. 59). None of the factors identified by Vannoy contributed substantially to the total variance. The largest factor accounted for only 24.3 percent of the common variance (ibid., p. 39). The absence in

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[7] Although Harvey (1966) posits concreteness-abstractness as a major generic dimension of complexity, in contrast to the emphatically integrative orientation of Schroder et al. (1967), his TIB test is similar in both format and scoring to Schroder's PCT.

this study of a factor on which the complexity measures were positively and significantly loaded is attributable to the homogeneous sample of college males, and to the use of tests which are known to intercorrelate lowly. The infrequency of factorial studies like Vannoy's and the occasional report of correlations between complexity measures (Tuckman, 1966, p. 378) is surprising in view of the psychometric necessity of establishing a complexity factor which will facilitate an investigation of the nature and applied value of these systems.

CHAPTER II

COMPLEXITY THEORY, IMPLICIT HYPOTHESES AND PREDICTIONS

1. COMPLEXITY THEORY: THE SCHRODERIAN VIEW

Schroder et al. (1967, p. 3) begin by making a sharp distinction between <u>what</u> people think and <u>how</u> they think, noting that given the same amount of information, different people use different conceptual rules in processing it. Human information processing variables refer to how a person combines and relates information from his world. This has already been illustrated by a reference to Piaget's sequential, maturational stages in which development means the variety of ways the organism can relate items of information. This fact can also be illustrated by considering the remarkable differences in conceptual development found in a number of subhuman organisms.

In a series of rigorously controlled experiments with infra-humans at various levels on the phylogenetic scale (e.g., fish, pigeons, monkeys, and so forth), Bitterman (1965) investigated two types of rule learning: habit reversal and probability-learning. In habit-reversal experiments, a preference for visual stimulus A was established by constantly rewarding the animal for choosing it over B, which was an identical

visual stimulus. The preference would then be switched to B in the next experimental session by rewarding the animal for responding to B. In the following session, the preference would be switched back to A, and so on.

> Trained in this way, a rat or monkey shows a steady improvement in performance. It may make many errors in mastering early reversals, persisting in the choice of previously rewarded alternatives, but as training continues it shifts its preferences more and more readily. A fish, in contrast, shows no improvement at all; later reversals are accomplished no more readily than earlier ones (Bitterman, 1965, p. 92).

As one moves up the evolutionary ladder, in other words, effective adaptive behavior is accomplished with increasing ease.

The probability-learning experiments differed from the habit reversal trials in that the rewarded alternative stimulus was changed within a given session. For example, stimulus A would be rewarded on a random 70 percent of the trials, and B would be rewarded on the others. The members of all species tended to "maximize" (choose the 70 percent alternative on all trials) when they were trained without guidance, but when they were given guidance startling differences appeared. The guidance procedure consisted of illuminating the correct stimulus after the animal had made an incorrect choice. The animal was then rewarded if it responded to the guidance stimulus. Following guidance, the rat still tended to maximize, choosing the 70 percent alternative much more often than 70 percent of the time, but the

fish showed a very different choice pattern: it chose the 70 percent alternative about 70 percent of the time. Bitterman called this choice pattern "matching" (reward ratio = choice ratio) (Bitterman, 1965, p. 96), and gives a simple illustration of why it is maladaptive. Consider the number of rewards the rat and fish would earn over 100 trials: the rat chooses the 70 percent alternative 100 percent of the time and thus earns .70 X 100 = 70 rewards; but the fish chooses the 70 percent alternative 70 percent of the time for which it earns .70 X 70 = 49 rewards, and chooses the 30 percent alternative 30 percent of the time, for which it earns .30 X 30 = 9 rewards, making a total of 49 + 9 = 58 rewards (ibid., pp. 97-98).

The ability to maximize produces a higher percentage of correct responses, and thus may be regarded as being on a higher level than matching behavior. Such relatively high-level functioning is closely related to the development of the cerebral cortex, a development that is almost entirely absent in the brain of a fish. The rat, on the other hand, has a relatively large amount of cortical tissue. Bitterman comments that "as we ascend the evolutionary scale we do not find a pattern of intellectual continuity but one of discontinuity (ibid., p. 97)", in the sense that higher animals are capable of high-level intellectual "leaps" or "insights" that lower animals are not. "Progressive improvement in habit reversal represents

a flexibility that cannot help but be of value in an animal's adaptation to changing circumstances (ibid., p. 97)", while the adaptive value of maximization is also fairly obvious.

Human conceptual behavior is distinct from that of animals because it generates more alternatives: the human is not as stimulus bound as lower species, can perceive stimuli in many ways, and then interrelate these perceptions using a variety of schemata (rules) (Schroder et al., 1967, p. 5). The resulting behavior has high adaptive value. Even the most complex computers are primitive information-processing structures when compared to humans, for computers blindly follow the rules (even though these may be complex) which they are instructed to follow, and can continue functioning only if the environment remains static.

There are two major problems involved in identifying the level at which an individual typically processes information: determining the number of dimensional attributes of information perceived in an environment, and determining the degrees of freedom available in the integration of the attributes (Schroder et al., 1967, p. 14). As the conceptual structure becomes more complex, or emergent (ibid., p. 6), there is a probable increase in dimensionality or differentiation, but, more importantly, there is a <u>necessary</u> increase in the complexity and

number of combinatory schemata.

Emergent rule structures, on the other hand, are exemplified by exploratory and creative behavior in animals at the upper end of the evolution scale, as well as by other forms of integratively complex thought in which many perspectives and ways of interrelating these perspectives occur, and in which new rules can be generated for decision-making purposes. Within this class, also, systems differ in terms of the amount and speed of information processed, but they are similar in that new information-processing rules emerge within the system itself (Schroder et al., 1967, p. 6).

Although many separate levels of conceptual functioning could be identified, it is most convenient for illustrative purposes to discuss low (concrete) and high (abstract) integration indexes.[8]

The simple integrating structure is fixed, concrete and absolute: there are comparatively few degrees of freedom, stimuli are identified and organized in a swift, deterministic manner, the organization is rigidly hierarchical, and there is a high degree of compartmentalization.

Stimuli are evaluated more or less unidimensionally, and, from the subject's point of view, the problems of choice or error arise less frequently. Rules can be explicated more definitely, and there is a minimum of ambiguity. The structure can generate many hierarchically related categories about a given stimulus range, as well as unrelated or compartmentalized categories about dissimilar stimuli (ibid., p. 16).

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[8]Terms such as "integration index" and "hierarchical" are used in this study to refer to behavioral effects which reflect underlying psychological processes such as abstractness and concreteness.

There is a lack of conflict within the system resulting from this quick, rigid categorization of stimuli, and from the distortion or outright exclusion of new stimuli which do not neatly fit existing systems. Once the low-level structure is established, it is highly resistant to change.

A number of broad behavioral consequences follow from these properties. Thinking is typically "black-white", concrete, categorical and absolute. Conflict is minimized because stimuli are squeezed into existing categories or removed from consideration. Alternative interpretations or new perspectives do not arise so that " . . . behavior is maximally controlled by external stimulus conditions (ibid., p. 17)." Percepts and attitudes are vastly overgeneralized and insensitive to subtle situational changes, but when recategorization does occur it is abrupt and unequivocal.

As an integrating structure becomes more complex, it becomes less determinate (i.e., there are more degrees of freedom involved in the integrative process). This is accompanied by an increase in subjective uncertainty within the system as alternate combinations of dimensional scale values emerge. The high-level, complex integrating structure maximizes these qualities: it is highly abstract and capable of generating and applying laws that organize large bodies of information.

> Unlike the low level, which consists of a hierarchical set of established rules and procedures, high-level functioning . . . is characterized by the ability to generate the rules of the theory, the complex relations and alternate schemata, as well as the relationships between the various structures. It has the potential to generate alternate patterns of complex interactions (Schroder et al., 1967, p. 23).

The system can generate and handle a great deal of diversity, and can generate new and alternate schemata without imposition of new external conditions. It adapts quickly to complex, changing situations, and handles environmental stress well, even though the general effect of such stress is to reduce conceptual functioning to a more concrete level (ibid., pp. 90-100). Internal integrative processes achieve their greatest strength at this level of functioning, and the integratively-complex person can extract and utilize a maximum amount of information from a given stimulus situation.

In emphasizing and describing in detail the role of these information processing variables, Schroder and his co-authors have made a departure from Harvey (1966), who focuses in depth upon the behavioral outcomes associated with high and low complexity. In their recent work, Harvey et al. (1968) are explicitly concerned with the training behavior of concrete and abstract teachers in real classroom settings. Both Harvey and Schroder, however, take pains to describe the learning environments which are related to the development of simple and complex

structural properties. Given a facilitative training environment, most persons would develop relatively abstract conceptual structures. "However, under conditions that are other than optimal, development may be arrested at some point along the concrete-abstract continuum (Schroder et al., 1967, p. 45)." An optimal learning environment must not be oversimple or overcomplex, for either condition can prevent the emergence of abstractness (ibid., p. 46). There are two basic types of learning environment which the training agent can create.

The unilateral or deductive environment (ibid., p. 47) is one in which the subject learns to adapt by conforming to external schemata. He learns the required response, through punishments and rewards, to arbitrary rules and control imposed by the trainer.

> Unilateral training, through structuring the learning situation and inhibiting the emergence of alternate schemata, unrealistically oversimplifies the environment to which one is adapting, and endangers the potential development of abstract structural properties. It is characterized by conditions that provide a basis for learning stimulus-categorization by setting forth fixed rules. These rules determine placement and combination and restrict the opportunity for the person or group to generate new rules of combination (Schroder et al., 1967, p. 48).

Teaching methods which oversimplify the environment are easy to devise and use, but they soon habituate the learner to dependence on external schemata, and severely inhibit his exploratory and spontaneous activity. In a similar vein, Harvey (1966) contends that System I

functioning is the result of a learning environment in which the exploratory activity of the learner has been restricted.

In the interdependent or inductive learning environment, on the other hand, the trainer does not force-feed the learner with pre-fabricated schemata, but encourages him to generate these rules for himself. In this sort of training situation, environmental characteristics are of critical importance (Schroder et al., 1967, p. 48). The environment must contain all the requisite learning components, must facilitate exploration by and feedback to the learner, and must in general encourage an adaptive orientation stressing autonomous discovery of complex integrative rules (ibid., p. 49). Unfortunately, "at the present time, few truly interdependent training methods have been developed for teaching purposes (ibid., p. 49)." The trainer's role in inductive learning is particularly difficult: he must allow the learner to experience the consequences of action, but he must not provide excessive information about such consequences; he must arrange for optimal differentiation and interdependence of the environment, but must not allow the learner to become swamped by a surplus of diversity; he must, in short, teach at some sort of midpoint on the structured-unstructured dimension. This is the sort of position taken by Ausubel (1963), who contends that verbal-expository

teaching must provide the fundamental information, sufficiently organized, on the basis of which discovery learning can take place. Harvey (1966) also notes that before abstract structure can develop the learner must be given freedom to explore the environment, social and physical, but adds that the learner must be allowed " . . . to solve problems and evolve solutions without fear of punishment for deviating from the established truth (1966, p. 45)." The creation of such an environment would, of course, require that the trainer himself be a person of relatively high complexity. Take, for example, the social conditions associated with discovery in general. The function of these conditions is to remove the penalties attendant upon unorthodox ideas and thereby allow any potentially creative individual to entertain the possibility, in Toulmin's (1963) phrase of " . . . rejecting authority, and establishing the superiority of a modified system of ideas (Toulmin, 1963, p. 170)."

2. SOME HYPOTHESES IMPLICIT IN COMPLEXITY THEORY AND RELATED SPECIFIC PREDICTIONS

Schroder et al. (1967) describe the integratively-simple person as highly dependent on external stimulus conditions (ibid., p. 17), and as significantly more likely than a complex person to change an attitude when salient contradictory information is presented in a context of

sensory deprivation (ibid., pp. 137-138). Harvey (1966) pictures the System I representative as positively dependent on authority and highly conventional. The learning environment associated with the development of cognitive simplicity is one of restriction and punitiveness, interspersed with praise and rewards. Such an environment is highly conducive to the emergence of strong dependency relationships, and the cognitively simple person is clearly a highly dependent, passive, acquiescent personality extremely susceptible to conventional, normative or socially-prescriptive influences.

It has already been noted (Schroder et al., 1967; Harvey, 1966) that the integratively-complex person is less stimulus-bound, more differentiated, less dependent on external schemata, and more active in construing the stimulus situation than is the cognitively-simple person. Cognitive complexity is facilitated by training environments where spontaneous exploratory activity is encouraged, and where the learner is permitted to freely and vigorously inquire into the interdependent aspects of the environment.

(1) Birth Order

Now it is well established in the literature that firstborn children are more susceptible to social pressure and are more dependent than laterborns (Sears, 1950; Shachter, 1959; Carrigan and Julian, 1966; Becker and Carroll, 1962), with firstborn boys more conforming under

stress than firstborn girls (Carrigan and Julian, 1966). Stewart (1967), using an all-male sample, found firstborns to be more field-dependent than laterborns. Hilton (1967), in an experimental attempt to identify some of the antecedents of these behaviors, found that mothers of firstborns were more involved (interfering) than mothers of laterborns, and more encouraging of dependent behavior.

On the basis of these findings, it is plausible to hypothesize that there will be a negative relationship between birth order and cognitive complexity. The specific prediction related to this hypothesis is that on a test of significance between means on the complexity measures, firstborn subjects will be of lower cognitive complexity than laterborn subjects.

(2) Field Dependence

Field dependence is the perceptual expression of a global, undifferentiated cognitive style (Witkin, Lewis, Hertzman, Machover, Meissner and Wapner, 1954; Witkin, 1965), while field independence is characterized by an articulated (differentiated), analytic and active style (Witkin, 1965, p. 319). Field dependence has certain important personality correlates: conformity to social pressure (Linton, 1955), disruption in the face of uncertainty (Gross, 1959), and disquietude in sensory-deprivation situations (Silverman, Cohen, Shmavonian and Greenberg, 1961; Bertini, Lewis and

Witkin, 1964).

Harvey (1966) reports that eleven representatives of his four nodal conceptual systems completed the Gottschaldt Embedded Figures Test (a well-known field dependency measure), and that the order of performance, from lowest to highest, was sequential (Systems 1, 2, 3, and 4, in that order). System 4 performance, however, was widely separated from performance by representatives of the other three systems. These considerations make plausible the hypothesis that field independence is positively related to cognitive complexity. The specific prediction related to the hypothesis is that the Embedded Figures Test V will load positively and significantly on a factor which is representative of cognitive complexity.

(3) Social Acquiescence

Social acquiescence is a factor-analytically derived dimension (Bass, 1958) which is measured by the Social Acquiescence (SA) scale of the Famous Sayings Test. Bass (1958) contends that persons high in social acquiescence tend to "accept <u>any</u> generalizations about human behavior" and appear to be " . . . insensitive, non-intellectual, socially uncritical individuals -- unquestioning conformists to social demands (ibid., pp. 481-482)." Vidulich and Bass (1960) report a correlation of .40 between the SA scale and Rokeach's (1960)

dogmatism scale. Braun and Dube (1963) found SA scores to be positively related to ethnocentrism and authoritarianism, and negatively related to amount of education.

These findings make likely the hypothesis that there is a positive relationship between social acquiescence and cognitive simplicity. The specific prediction related to this hypothesis is that the SA scale will load negatively and significantly on a factor representative of cognitive complexity.

(4) Internal-External Control

Lefcourt (1966) defines internal control as "the perception of positive and/or negative events as being a consequence of one's own actions and thereby under personal control . . . (1966, p. 207)", while external control refers to " . . . the perception of positive and/or negative events as being unrelated to one's own behaviors in certain situations and therefore beyond personal control (ibid., p. 207)." The construct is measured on the Internal-External (I-E) Scale, and Rotter (1966) contends that its " . . . items deal exclusively with the subject's belief about the nature of the world (1966, p. 10)." Research into the personality correlates of externality (high belief in external control) has shown that external subjects show a greater tendency to conform than internals (Odell, 1959), yield significantly more often in Asch-type situations (Crowne and Liverant, 1963), and show

less tendency to regulate their behavior to cope with objective probabilities (Liverant and Scodel, 1960).

On the basis of these findings it is plausible to hypothesize that there will be a negative relationship between externality and cognitive complexity, and to make the prediction that the I-E Scale will load negatively and significantly on a factor representative of cognitive complexity.

(5) Religious Orientation

Although churchgoers have regularly been found to be more prejudiced than non-churchgoers (Allport and Kramer, 1946; Stouffer, 1955; Wilson, 1960), people who attend church frequently are often less prejudiced than non-attenders or non-religious people (Holtzman, 1956; Pettigrew, 1959; Pinkney, 1961). Allport and Ross (1967) explain this difference using the extrinsic-versus-intrinsic dimension of religious motivation. They found intrinsically, or deeply, religious subjects to be significantly less prejudiced than extrinsically, or superficially, religious subjects, who are mainly interested in the material and social benefits of churchgoing. In addition, they identified a category of religious orientation which they labelled "indiscriminately pro-religious". Indiscriminately pro-religious subjects were those who tended to endorse any items seeming to favor religion. They were even more prejudiced than extrinsic

subjects, which Allport and Ross attribute to a cognitive style characterized by "dogmatism", "undifferentiated thinking" and "excessive category width" (Allport and Ross, 1967, p. 441)."

This description allows the hypothesis that indiscriminately pro-religious subjects will tend to be cognitively simple. The prediction related to this hypothesis is that on a test of significance between means on the complexity measures, indiscriminately pro-religious subjects will be of lower cognitive complexity than other subjects in the sample.

3. RECAPITULATION OF HYPOTHESES

As has previously been indicated in a general way, the main hypothesis to be tested in the present study is that there is a significant positive relationship among a a number of cognitive complexity measures, possible measures of complexity, and measures of possible correlates of complexity. On the basis of this hypothesis, it is predicted that at least several of these measures will load on a factor which broadly represents cognitive complexity. The various measures used in the study are described in detail in Chapter III. Minor hypotheses and related predictions to be tested have been outlined in the immediately preceding pages.

CHAPTER III

SUBJECTS AND MEASUREMENTS

1. THE SAMPLE

The sample consisted of 109 grade ten and eleven students in the Kitscoty and Marwayne High Schools (Kitscoty, n = 48; Marwayne, n = 61), which are located in rural eastern Alberta. There were 49 females and 60 males in the sample. 25 of the subjects were firstborn children, and 84 were laterborn. All spoke English as their first language.

2. ADMINISTRATION OF THE TESTS

The entire test battery was administered to the Kitscoty students on the morning of April 10, 1968, and to the Marwayne students on the following morning. The author supervised the administration.

The tests were given in the following order on both mornings:

Gestalt Transformations
Associations IV
Seeing Deficiencies
Inference Test
Embedded Figures Test V
Paragraph Completion Test
This-I-Believe Test

Internal-External Scale
Groups of Nations Test
People You Know

Interpersonal Topical Inventory
What Goes With What
SA Scale, Famous Sayings Test
Preferred Choices
Religious Orientation Scale

The first seven tests, all of which are timed, were clocked by stopwatch and were followed by a brief recess. All the students in both schools had sufficient time to complete the test battery. The author read all the instructions on each test to the students, and answered any questions that were raised.

3. DESCRIPTION OF THE MEASUREMENT INSTRUMENTS

The fifteen tests used in the study are briefly described on the following pages. A number of original or revised scoring procedures were used, and these are explained fully. Four of the tests are measures of cognitive complexity, seven are possible measures of complexity, and four are measures of correlates of this dimension. It was expected that on the assumption of a broad factor of complexity grouping at least some of the complexity measures and correlate measures would load significantly and positively on this general variable.

(I) Tests of Cognitive Complexity

The Interpersonal Topical Inventory. The Interpersonal Topical Inventory (ITI) is a forced-choice measure of integrative complexity devised by Tuckman (1966). When his scoring procedures are used, the test

allows an experimenter to classify a subject into one of four conceptual systems on the basis of the number of responses he makes belonging to each system. The systems increase in complexity from system 1 to system 4. Tuckman (1966, p. 378) reports a contingency coefficient of .54 (out of a possible maximum .87) between his ITI and Schroder's Paragraph Completion Test, based on four-system classification of 92 subjects.

Six stems are used on the ITI (When I am criticized . . .; When I am in doubt . . .; When a friend acts differently toward me . . .; This I believe about people . . .; Leaders . . .; When other people find fault with me . . .) and six pairs of alternatives, lettered "A" and "B", follow each stem. Of the total of 72 alternatives, 18 fall into each of the four conceptual systems, and the subject's maximum possible score for any one system is thus 18.

In Tuckman's words the stems are "meant to confront the individuals with interpersonal conflict, ambiguity, and the imposition of control (1966, p. 373)." He provides classification norms based on scores made by 461 naval enlistees (median age = 18) and scores made by 90 Rutgers College freshmen. The subject is given four raw scores, which are simply the number of choices he makes falling into each conceptual system, and is then classified into that system in which he scores in the

eighth, ninth or tenth decile, provided that he scores in a lower decile in all the other systems. Tuckman states that any subject scoring equally high in more than one system cannot be classified.

It became apparent early in the present investigation that a relatively large number of subjects were not amenable to classification using these procedures. With this in mind, the author devised two scoring protocols which permitted categorization of all the subjects. The first procedure consisted of noting the number of times the subject chose the more complex alternative of each pair of alternatives. He was then assigned a score of 1 for each more-complex choice made, and a score of -1 for each choice of a less-complex alternative. These scores were summed over the entire 36 pairs of alternatives, yielding a possible score range of 36 to -36, with a high positive score being regarded as indicative of high integrative complexity.

The second procedure was a derivative of the first. Where a subject had chosen a more-complex over a less-complex alternative, he was assigned a positive score equal to the numerical value of the difference between the systems to which the alternatives belonged. For example, if the subject had chosen alternative "A", belonging to conceptual system 4, over alternative "B", belonging to system 1, he was assigned a score of 3. Similarly, when

he chose the least-complex alternative of the two, he was given a negative score equal to the value of the difference between systems. The negative and positive scores were again summed over the 36 pairs of alternatives, with a high positive score indicating high complexity. The theoretical score range using this scheme extends from 60 to -60.

Scoring the ITI in this manner can be justified on the grounds that an integratively-complex person should show a consistent tendency to choose more-complex over less-complex responses. Similarly, a person of low complexity should consistently choose alternatives of relatively low complexity.

The This-I-Believe Test. Developed by Harvey (1964, 1965), the This-I-Believe (TIB) Test is a projective measure of complexity which is similar in form to the Schroder Paraph Completion Test.[9] The subject is asked to complete in two or three sentences the stem "This I believe about _____", the blank being filled by such referents as "friendship", "myself", "people", and, for the present

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[9]Schroder et al. (1967) claim that "Harvey's . . . 'this I believe' test . . . has only a low-order relationship to the paragraph completion test . . . because it (the TIB test) is scored largely on a 'content' basis (1967, p. 115)." In practise, however, scoring referents outlined by Schroder et al. (1967, p. 26) and Harvey (1966, p. 47) point to considerable similarity between the two measures. Although Harvey generally avoids using the term "integrative complexity" in his more recent work, the concept of integration is logically implicit in and inextricable from his theoretical position.

investigation, "the Canadian way of life". High school students are given two minutes to complete each stem. On the basis of their responses, subjects are classified into one of the four nodal systems of integrative complexity described by Harvey (1966).

In outlining the criteria used in classifying respondents, Harvey (1966) states that

> some of the more important determinants of a subject's classification include the absolutism of his expressed beliefs, consideration of contingencies or modifying circumstances, dependency on external authorities, especially God and/or religion, frequency of trite and normative statements, degree of ethnocentrism, acceptance of socially approved modes of behavior, concern with interpersonal relationships, and the apparent simplicity-complexity of the interpretations of the world (1966, p. 47).

He also mentions that considering responses to all the TIB referents in totality and assigning an overall score has consistently produced greater validity and higher reliability than has single item analysis. Using this global approach, " . . . interjudge reliability . . . has been .90 or above for 12 different samples of subjects (ibid., p. 47)."

In addition to this overall assessment, a revised scoring system was adopted in which complex or abstract responses were assigned a score of 4, and concrete or simple responses a score of -1. These weightings were summed over the test stems to produce a single score.

The Schroder Paragraph Completion Test. The Schroder Paragraph Completion Test is also a projective measure of integrative complexity on which the subject

is asked to write two or three sentences in response to each of a series of sentence stems appearing on separate pages (Schroder et al., 1967, pp. 189-198). High school age subjects are generally allowed two minutes in which to respond to each stem.

Schroder and his co-authors claim that the stems producing the highest inter-rater reliability are those: (a) implying the presence of alternatives, uncertainty, or absence of structure ("When I am in doubt . . .", "Confusion . . ."), (b) implying the imposition of external standards ("Rules . . .", "Parents . . ."), and (c) implying interpersonal conflict ("When I am criticized . . .", "When others criticize me it usually means . . .") (ibid., p. 190). They note that satisfactory inter-rater reliabilities can be achieved "in about four days of concentrated work (ibid., p. 190)" when the raters are familiar with the theoretical variables.

The six-stem version of the test was used in this study, and was scored using criteria outlined in Schroder et al. (1967, pp. 189-198). Schroder's four point single classification system was used for the purpose of primary classification, but a different system was devised for correlational and analytical purposes.

In the modified system, each highly complex response to a stem was assigned a weighting of 4, and each cognitively simple response given a score of -1. These

weightings were summed over the six stems to afford a single score. Responses of intermediate complexity were not included in this procedure in an attempt to eliminate variance that might have been due to less purely cognitive factors. This is in keeping with research that has eliminated representatives of intermediate systems in analyzing the results (Harvey and Ware, 1967; Joyce et al., 1966).

The Scott Groups of Nations Test. The Groups of Nations Test is an original measure of complexity developed by Scott (1962). The subject is given a list of twenty nations, and is instructed to group them on the basis of any qualities he can think of. The subject can form as many groups as he pleases, but he must choose only from the countries on the list. A typical grouping might be China (mainland), Germany (East), Czechoslovakia and the USSR (Russia) on the basis of the quality "communist governments".

Scott's scoring procedure is borrowed from information theory (Attneave, 1959), but tends to produce an extremely skewed distribution (Vannoy, 1964). Accordingly, a revised scoring procedure was adopted for the present study. The first step in this procedure involved a simple count of the number of groups formed by each subject, which Vannoy (1964) used as a crude measure to salvage data from the test. Additionally, however, each subject was assigned

a score based on the relative or qualitative complexity of the concepts used in forming the groups.

Simple geographical concepts were assigned a score of 1, since they were used by almost every subject, but political, economic and cultural concepts were given a score of 2, since they were judged to be of greater complexity. Any highly original or unusual concepts considered to be of some merit were assigned a weighting of 3. The number-of-groups score and the qualitative-concepts score were then summed, yielding the subject's combined score. A detailed scoring key may be found in Appendix C of this document.

It should be noted that when a subject used a concept falling into a certain category, he was given no further qualitative-concept points for that category. For example, if the subject produced ten groupings on the basis of simple geographical concepts, he would receive a number-of-groups score of 10, but a qualitative-concepts score of only 1.

(2) Possible Measures of Complexity

Preferred Choices. The form of this instrument administered in the current study consisted of 18 interpersonal perception scales on which the subject was asked to rate his least and most-preferred co-students. It closely followed the version of the test described by

Fiedler (1962), with the exception that his subjects were asked to rate co-workers over 20 scales.

The test yields two important scores: Esteem for the Least Preferred Co-student (LPC), and the Assumed Similarity between Opposites (ASo) score. The LPC score is obtained by "assigning the maximum score (i.e., 8) to the most favorable pole of the LPC description, and summing the scores over all . . . scale items (Fiedler, 1962, p. 308)." The ASo score, on the other hand, is calculated by squaring the difference between the rating assigned the most-preferred and least-preferred student on each scale, and summing the squares over the number of rating scales employed.

$$ASo = \sum_{i=1}^{N} (g - b)^2$$

where (g - b) equals the difference between the ratings given the favored and disliked student on each scale, and N equals the number of rating scales employed.

A high LPC score indicates that the subject perceives the disliked student relatively favorably, while a low ASo score means that the subject sees little difference between his most and least-preferred co-students.

It would seem reasonable to postulate, on the basis of previously described theoretical considerations, that the cognitively simple person, who typically thinks

in black-white terms, would see his least-preferred co-student as "all bad", and his most-preferred co-student as "all good". He would thus earn a low LPC score, but a high ASo score. The cognitively complex person, conversely, might well perceive a mixture of positive and negative traits in his most and least-preferred choices. As such, the Preferred Choices measure might prove a useful test of the construct.

What Goes With What. Based loosely on impression-formation work by Asch (1946), and Bruner, Shapiro and Tagiuri (1958), the What-Goes-With-What test is an original measure of impression formation. The subject is given a list of three traits presumed to be descriptive of an individual and is asked to rate the plausibility of the description on a four-point scale from "most plausible" to "most implausible". One of the three traits in each group appears to contradict the other two.

The test was chosen for the current investigation on the grounds that a cognitively complex person would be able to easily integrate the traits in each description on the basis of perception of a diversity of traits within individuals, while the cognitively simple person would perceive the traits as contradictory and implausible.

Two scoring systems were used. In the first, the subject was given a score of 4 for each "most plausible" rating he assigned a trait description, a score of 3

for each "plausible" rating, 2 for each "implausible" rating, and 1 for each "most implausible" rating. These scores were then summed over the 15 descriptions contained in the test. The second system consisted of summing the 4 scores, and subtracting the 1's from this sum. Intermediate scores were not considered in the summation.

People You Know. The People-You-Know test is a modification of Bieri et al.'s (1966) group version of the Rep Test, which was originally developed by Kelly (1955). On the Rep Test, the subject is asked to judge a number of significant persons using a grid and a supplied series of bi-polar dimensions. A detailed description of the modified version may be found in Bieri et al. (1966, pp. 189-192). The Rep Test was considered unsuitable for the present study because it is a time-consuming measure to administer. The People-You-Know test preserves the essential features of the Rep Test, but takes only about 15 minutes to administer.

On this test the subject is instructed to rate seven significant persons (himself, a friend of the same sex, the person he dislikes most, his father, his mother, and so on) on a standard check list. He is asked to check all the qualities which accurately describe the person being rated.

Three scoring systems were used with the test. The first consisted of tallying the total number of

qualities the subject checked in rating the seven significant persons, on the reasoning that a cognitively complex person would perceive more qualities in both liked and disliked others than would a simple person. The subject was assigned a score of 1 for each choice of a quality (e.g., honest), and was given an additional score of 1 if he rated the person as strongly possessing that quality (e.g., very honest). The assigned points were then summed over the seven checklists.

The second system was qualitatively similar to the ASo scoring procedure on the Preferred Choices Test. The differences between the total number of qualities chosen for each of the seven rated persons were squared and summed. For example, if the subject perceived 22 qualities in himself (scored as in the first system), and 26 in his mother, his squared-difference score between those two scales would be 16. The rationale for this procedure was that the conceptually complex person would perceive a relatively large number of qualities in all the persons he rated, and would thus earn a low squared-differences score. The cognitively simple person, conversely, would see very few qualities other than strongly negative ones in disliked persons, while he would see liked persons as possessing almost all of the desirable attributes listed on the checklist. His squared-differences score would thus tend to be

rather high.

The third system was designed to measure the number of superficially contradictory qualities the subject perceived in the rated persons. Each time he checked mildly contradictory qualities (e.g., dependent versus independent) on the same checklist, he was given a score of 1; each time he checked moderately contradictory qualities (e.g., dependent versus very independent), he was given a score of 2; and each time he checked highly contradictory qualities (e.g., very dependent versus very independent), he was given a score of 3. These scores were subtotaled on each checklist, and a grand total was obtained over the seven checklists. This system was used on the grounds that a cognitively complex person would be able to perceive seemingly opposite qualities in a rated person much more easily than would a cognitively simple person (Harvey and Ware, 1967).

Inference Test. The inference test used in this study is an adaptation of the one used by Berger, Guilford and Christensen (1957). The subject reads an informational statement and is asked to identify which one of five given conclusions to the statement is correct, assuming no information beyond that given in the statement. His score is the number of correct conclusions he names. The test is made up of two sections, each one lasting six minutes.

The Inference Test loads on the logical evaluation factor (Berger et al., 1957), which has also been called "syllogistic reasoning" (French, Ekstrom and Price, 1963) and consists of the evaluation of semantic relations. The test also loads on a factor labelled "ordering" which is "the ability to arrange objects or events, or to define an arrangement of objects or events, in a sequence that is meaningful either in terms of time, hierarchical or causal relationship (Berger et al., 1957, p. 26)."

The Inference Test was chosen as a probable measure of complexity on the grounds that subjects must perceive the dimensions of information given in the item stems, and then confine themselves to only those dimensions in reasoning their way to the correct conclusion. The process of selecting, and then organizing, relevant informational attributes seems a likely precondition of complexity.

Associations IV. The subject is required to produce a word linking two given words on this test by Guilford. The linking word must have a different meaning in relation to each of the given words. For example, "ring" links the given words "jewelry" and "bell"; a ring is a piece of jewelry, and a bell rings. The test is composed of two fifteen-question sections, with a seven minute time limit for each section. The subject's

score is the number of correct associations he gives.

The test loads on the associational fluency factor (Kettner, Guilford and Christensen, 1959). Subjects having a number of associations tied to a given word tend to do well on this test, which measures "the ability to produce words from a restricted area of meaning (Kettner et al., 1959, p. 25)." The Associations IV test may be construed as a measure of complexity to the extent that a complex person should be less tied to a single, fixed association than would a simple person (Sieber and Lanzetta, 1966, p. 569). Associational fluency would seem to be a necessary though not sufficient condition of complexity.

Gestalt Transformations. Developed by Guilford, Wilson and Christensen (1952), the Gestalt Transformations test has been used in other contexts as a creativity measure (Tuckman, 1966; Garwood, 1964). The subject is asked to identify an object containing a part that may be used to solve a problem. For example, the crystal from a pocket watch could be used to start a fire, even though its use as a focusing lens is not usual. The subject's raw score is the number of such objects he correctly identifies. The test is administered in two sections of ten questions each, and the subject is given five minutes working time for each section.

Gestalt Transformations usually loads on the

semantic transformations factor (Hertzka, Christensen and Berger, 1954) but in at least one study (Merrifield, Guilford, Christensen and Frick, 1962) has loaded on a factor identified as convergent production of semantic relationships which has been defined as "the production of a unique relationship implied by the conjunction of two or more concepts (Merrifield et al., 1962, p. 3)." In another investigation (Kettner et al., 1959) it loaded on a factor labelled redefinition and judgement. "Judgement was defined . . . as the ability to make wise choices in a somewhat ambiguous situation where it is necessary, in general, to make assumptions over and above the facts that are given (ibid., p. 26)."

Conceptual complexity includes the ability to overcome functional fixedness and go beyond the information given. The cognitively complex person theoretically possesses the ability to spontaneously generate new schemata in an ambiguous situation (Schroder et al., 1967, p. 25), while the conceptually simple person remains bound by the stimulus configuration (ibid., p. 23).

Seeing Deficiencies. On this instrument, the subject is given a brief description of a proposed plan, and is asked to write a brief explanation pointing out the flaw or defect in the plan which prevents it from functioning effectively. The test is administered in two sections

of ten questions each, and the subject is allowed ten minutes to complete each section. His score is the number of deficiencies he correctly identifies. The test was first used in a Guilford factor-analytic study (Kettner et al., 1959).

The cognitively simple person, who accepts what is given, is not very likely to see deficiencies, whereas the complex person, viewing phenomena from many related points of view and being able to take an independent stand, is likely to be able to effectively identify flaws (Karlins, 1967).

(3) Tests of Correlates of Complexity

Religious Orientation Scale. The Religious Orientation Scale used by Allport and Ross (1967) is a 20-item multiple-choice instrument, on which 9 items form the intrinsic subscale and 11 the extrinsic subscale. A score of 1 is assigned to the most intrinsic response on all items, while a score of 5 represents the most extrinsic response to an item. Items left blank are given a score of 3 and the total scores on each subscale are summed and compared.

The indiscriminately pro-religious person is one who scores at least 12 points less on the intrinsic subscale than on the extrinsic subscale. Allport and Ross (1967) explain that "this figure reflects the fact that a subject gives approximately 50% more intrinsic responses

. . . than we should expect from his extrinsic responses . . . (1967, p. 438)." The intrinsically-religious individual, on the other hand, is one who agrees with the intrinsic items but diagrees with the extrinsic items, while the extrinsically-religious subject agrees with extrinsic but not with intrinsic items. The indiscriminately anti-religious or non-religious person is one who shows a strong tendency to disagree with all the items, but since Allport and Ross excluded non-churchgoers from their sample, this type of person was not found in their study.

The Embedded Figures Test, Form V. The first measures of field-dependence were laboratory spatial orientation procedures such as the rod-and-frame test, which were individually administered. Later it was found (Witkin, 1950) that a printed Embedded Figures Test (EFT) made up of colored Gottschaldt figures corresponded sufficiently with the laboratory measures to provide an economical, easy-to-use test of the construct.

Form V of the EFT consists of a 16 item, uncolored booklet form of the test. The form requires memory: the simple figures are presented on one side of a page, and the complex patterns on the obverse side. The subject is required to draw in as many of the simple figures as he can in 10 minutes, and his score is the number of simple patterns he identifies and traces correctly within the time

limit. Jackson, Messick and Myers (1964) comment that if "one's aim is to reproduce as closely as possible with a group test what the individual form of the Witkin EFT measures, then the group forms requiring memory should be used (1964, p. 189)." These authors also note that "when an economical group measure of embedded-figures performance is required and it is desired to preserve the memory feature of the Witkin items, Form V should serve well (ibid., p. 188)."

The Social Acquiescence Scale of the Famous Sayings Test. The Famous Sayings Test is a disguised personality measure developed by Bass (1958), in which the subject records agreement or disagreement with 131 well-known proverbs. The test contains four factor-analytically derived subscales, of which the Social Acquiescence (SA) scale is one. In the present investigation, the 41-item short form of the scale was administered. The SA raw score is the simple sum of the number of "yes" responses to the proverbs composing the scale. A high raw score is indicative of high social acquiescence.

The Internal-External Scale. The Internal-External (I-E) Scale is a refinement of the James-Phares Scale (James, 1957), which utilized a 26-item Likert format. Validation procedures on the I-E included an elimination of those items having a high correlation with the Marlowe-Crowne Social Desirability Scale, and selection

of items on the basis of internal consistency data (Rotter, Liverant and Crowne, 1965). Rotter (1966) reports negligible correlations between the I-E Scale and standardized intelligence tests, and reports that sex differences are usually minimal (1966, p. 14).

On each I-E item the subject is forced to choose between an externally-worded statement and an internally-worded one. His raw score is the total number of external choices he makes. The version of the scale used in the present research consisted of 25 items given by Rotter (1966, pp. 11-12), of which 3 were filler items designed to obscure the purpose of the test.

CHAPTER IV

ANALYSIS OF RESULTS

1. RESULTS OF THE FACTOR ANALYSIS

After scoring by the author, scores on all the measures were intercorrelated using the product-moment method, and the resulting matrix was factor-analyzed using the principal axes method. The seven resulting factors were rotated by the Varimax method. The intercorrelational matrix appears in Table 1, while selected correlations between original and revised scoring systems are presented in Table 2. Rotated factor loadings have been included in Table 3.

(1) Interpretation of the Factors

The first three factors were considered psychologically significant with reference to the present study, and they are interpreted briefly on the following pages.

FACTOR I

Measure	Loading
ITI - Revision #1	.914
ITI - Revision #2	.929
Schroder PCT	.758
PCT - Revision	.671
Harvey TIB Test	.586
TIB Test - Revision	.504

The high loadings on this factor of the Schroder

TABLE I

INTERCORRELATIONS OF THE TWENTY-FOUR MEASURES

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1.	ITI - Revision #1	1.000																							
2.	ITI - Revision #2	.947	1.000																						
3.	Schroder PCT	.573	.611	1.000																					
4.	PCT - Revision	.450	.505	.825	1.000																				
5.	Harvey TIB Test	.445	.471	.691	.666	1.000																			
6.	TIB Test - Revision	.366	.422	.630	.676	.872	1.000																		
7.	SA Scale - Famous Sayings	.049	.062	.227	.213	.126	.138	1.000																	
8.	Associations IV	.175	.191	.274	.246	.245	.224	.088	1.000																
9.	Gestalt Transformations	.007	.031	.308	.257	.255	.244	.301	.302	1.000															
10.	Seeing Deficiencies	.080	.083	.212	.216	.234	.242	.172	.191	.397	1.000														
11.	Inference Test	.187	.218	.227	.102	.234	.234	.165	.284	.469	.440	1.000													
12.	I-E Scale	.022	-.006	-.126	.025	-.033	.050	-.194	-.124	-.117	-.067	-.157	1.000												
13.	Preferred Choices - LPC	.025	.065	.098	.067	.041	.106	.048	.094	.148	.120	.078	.079	1.000											
14.	Preferred Choices - ASo	-.010	-.075	.001	.066	.100	.030	-.079	.192	-.049	.009	-.019	-.002	-.671	1.000										
15.	Groups of Nations	.170	.197	.315	.362	.223	.320	.032	.175	.305	.264	.277	-.056	-.033	.093	1.000									
16.	People You Know #1	.136	.150	.082	.217	.238	.345	-.016	.209	.000	.240	.065	.047	-.036	.287	.240	1.000								
17.	People You Know #2	.026	-.027	.083	.058	.132	.121	.051	.089	.076	.033	.098	-.040	-.087	.179	.020	.393	1.000							
18.	People You Know #3	.084	.093	-.019	.150	.171	.287	-.132	.112	-.103	.174	.020	.102	-.018	.177	.172	.790	.224	1.000						
19.	What Goes With What #1	-.010	.008	-.047	.044	.012	.087	.037	-.013	-.114	-.141	-.301	.102	-.009	-.102	-.068	.060	.059	.183	1.000					
20.	What Goes With What #2	-.002	.043	.061	.111	.104	.189	.041	-.038	-.192	-.153	-.374	-.001	-.050	.033	-.039	.213	.134	.210	.720	1.000				
21.	Embedded Figures Test V	.160	.140	.198	.142	.275	.254	-.002	.136	.200	.161	.240	-.006	-.002	.100	.216	.005	-.080	-.034	-.086	-.105	1.000			
22.	ROS*- Religious Orientation	-.083	-.113	-.203	-.175	-.255	-.277	-.201	.106	-.019	.136	-.142	.271	.014	.024	-.094	.073	-.060	.197	-.023	-.140	-.226	1.000		
23.	ROS - Intrinsic Subscale	-.215	-.239	-.294	-.206	-.371	-.340	-.214	.048	.005	.090	-.127	.240	.076	-.067	-.087	.001	-.052	.114	.049	-.119	-.217	.885	1.000	
24.	ROS - Church Attendance	-.074	-.133	-.162	-.037	-.096	-.079	-.227	.045	.053	.077	-.005	.232	.024	-.036	.048	.217	.076	.254	.005	-.134	-.083	.623	.660	1.000

*ROS - Religious Orientation Scale

TABLE 2

CORRELATIONS* BETWEEN SCORING SYSTEMS ON MULTI-SCORE MEASURES

ITI Revision #1 - ITI Revision #2	.947
Schroder PCT - PCT Revision	.825
Harvey TIB Test - TIB Test Revision	.872
Preferred Choices LPC - Preferred Choices ASo	-.671
People You Know #1 - People You Know #2	.393
People You Know #2 - People You Know #3	.224
People You Know #3 - People You Know #1	.790
What Goes With What #1 - What Goes With What #2	.720
ROS, Religious Orientation - ROS, Intrinsic Sub.	.885
ROS, Religious Orientation - ROS, Church Attend.	.623
ROS, Church Attendance - ROS, Intrinsic Subscale	.720

*all significant beyond the .01 level

TABLE 3

VARIMAX ROTATED FACTOR MATRIX

Measure	Factor 1	2	3	4	5	6	7
1. ITI - Revision #1	.914	-.053	-.039	.063	-.135	-.064	.012
2. ITI - Revision #2	.929	-.085	-.010	.060	-.098	-.036	.072
3. Schroder PCT	.758	-.120	.352	-.060	.071	.305	.008
4. PCT - Revision	.671	.004	.453	.035	.210	.216	-.025
5. Harvey TIB Test	.586	-.190	.554	.151	.118	.122	-.010
6. TIB Test - Revision	.504	-.179	.628	.252	.201	.083	.092
7. SA Scale - Famous Sayings	.071	-.225	-.031	-.075	.130	.663	.082
8. Associations IV	.244	.193	.166	.146	-.070	.457	-.133
9. Gestalt Transformations	-.008	.108	.460	-.084	-.159	.651	.116
10. Seeing Deficiencies	.024	.182	.401	.232	-.256	.406	.148
11. Inference Test	.107	-.085	.306	.154	-.572	.404	.121
12. I-E Scale	.014	.371	.227	-.049	.136	-.500	.096
13. Preferred Choices - LPC	.047	.054	.055	.003	-.024	.052	.891
14. Preferred Choices - ASo	-.020	.003	.131	.203	-.036	.000	-.896
15. Groups of Nations	.145	.026	.537	.151	-.108	.143	-.075
16. People You Know #1	.114	.095	.168	.894	.060	-.020	-.086
17. People You Know #2	.004	-.085	-.119	.589	.047	.235	-.125
18. People You Know #3	.063	.193	.148	.832	.123	-.172	.000
19. What Goes With What #1	-.011	.038	-.035	.077	.840	.007	.078
20. What Goes With What #2	.043	-.144	-.044	.204	.857	-.012	-.026
21. Embedded Figures Test V	.039	-.183	.639	-.122	-.182	-.117	-.070
22. ROS*- Religious Orientation	-.037	.924	-.168	.024	-.038	-.020	-.037
23. ROS - Intrinsic Subscale	-.186	.913	-.162	-.029	.004	.003	.047
24. ROS - Church Attendance	-.070	.781	.060	.181	-.051	-.087	.037
% of Common Variance	20.9%	16.7%	14.5%	13.3%	12.6%	11.6%	10.4%

*ROS - Religious Orientation Scale

PCT and tests similar to the PCT suggest that this factor is specifically descriptive of integrative complexity. In Vannoy's (1964) study, the 11-stem version of the Schroder PCT loaded on a factor by itself, but this may be explained by the fact that the Vannoy battery was largely composed of measures designed to measure the number of dimensions used in handling input. The items on Tuckman's ITI, however, offer the subject a clear choice of schemata of varying levels of complexity, while the proffered PCT and TIB stems are a reliable device of a projective sort (Schroder et al., 1967) for calling forth the typical integrative pattern used by the subject in certain key social situations. The dimensionality-integration distinction is perhaps best drawn by Schroder and his co-authors (1967) when they state that "the number of dimensional attributes of information perceived has only a low-order relationship to the level of information processing involved, and it can only be used as an operation under special circumstances (1967, p. 14)." It is noteworthy that the dimension-oriented measures such as the Scott Groups of Nations test and the People You Know test had low positive loadings on this factor. Factor I can be fairly claimed to represent cognitive complexity.

FACTOR 2

Measure	Loading
ROS - Relgious Orientation	.924
ROS - Intrinsic Subscale	.913
ROS - Church Attendance	.781
I-E Scale	.371

A high positive score on the ROS - Religious Orientation scale is probably indicative of a non-religious or anti-religious orientation, a high score on the ROS - Intrinsic Subscale signifies low intrinsicness and rejection of intrinsically-worded items, while a high score on the ROS - Church Attendance item indicates infrequent or non-attendance at church. The high loadings of all these scores on factor 2 makes it seem logical to label the factor "religious rejection". This is meaningful in terms of Harvey et al.'s (1968, p. 164) report that "religiosity" is such a basic and consistent correlate of complexity that it may be termed the only fundamental condition, along with freedom of discovery, of its appearance.

In discussing the specific relationship of certain religious variables to the nodal systems of complexity, Harvey (1966) notes that religion has consistently distinguished among the four systems (1966, p. 48). Representatives of Systems 2 and 4 rarely attend chruch; of the individuals describing themselves as "not at all religious", the majority were System 2 representatives; System 2 and 4 individuals tended to agree with

the statement that there is too much emphasis given to religion in America, in contrast to System 1 and 3 individuals; persons from Systems 2 and 4 almost unanimously disagreed that "Everyone has the need to worship God (ibid., p. 49)." Harvey concludes by commenting that "while persons from both System 2 and System 4 tend to be low in religious beliefs or participation, System 2 individuals, far more than representatives of System 4, are likely to express a negative attitude toward religion and things associated with it (ibid., p. 49)." Presumably the anti-religious attitude of System 2 individuals is an emotional one, associated with their negativism, while that of System 4 individuals is of a more analytic, intellectual sort.

This finding is consonant with the loadings of the main complexity measures on factor 2 (ITI - Revision #2, -.085; Harvey TIB Test, -.190; Schroder PCT, -.120). Clearly the modal person rejecting religiosity in the present study was relatively low in complexity, but functioning at a level above System 1. The negative loading of the Embedded Figures Test V (-.183) further corroborates this hypothesis. This finding also points to the psychological basis of the psychometric orientation taken in this study (Allport and Ross, 1967). In Witkin's (1965) terms, we are dealing with a relatively global, undifferentiated cognitive style, rather than with an

articulated, highly analytical style. Harvey (1966, p. 45) describes the System 2 representative as rejective of most social and religious prescriptions, which is significant in view of the fact that the SA Scale, Famous Sayings Test loading on this factor was -.225; the person rejecting religious statements also rejected socially acquiescent generalizations about behavior. And finally, this same person was externally oriented as evidenced by the substantial I-E Scale loading on the factor. Such an orientation is consistent with the rejection of intrinsic religious beliefs, since these beliefs fairly obviously involve an internalization of religious dogma. The emergent pattern is clear. Factor 2 describes not only a pattern of "religious rejection", but also a generalized rejection of social prescription which discriminates among individuals of varying complexity.

FACTOR 3

Measure	Loading
Schroder PCT	.352
PCT - Revision	.453
Harvey TIB Test	.554
TIB Test - Revision	.628
Gestalt Transformations	.460
Seeing Deficiencies	.401
Inference Test	.306
Groups of Nations	.537
Embedded Figures Test V	.639

Factor 3 would appear to be descriptive of informational dimensionality or cognitive differentiation.

It should be noted that the PCT and TIB to some extent measure dimensionality, while the Scott Groups of Nations test is specifically dimensional. The Groups of Nations scoring system used in the present study rewarded the subject who used a number of qualitatively different concepts in grouping the nations. The Embedded Figures Test V, of course, is a much-used measure of perceptual and cognitive differentiation.

The loading of the Inference Test on this factor is consistent with the perception of relevant informational dimensions required in its item stems. Similarly, to succeed on Gestalt Transformations the subject must perceive one of many component parts as relevant before he can solve the problem. And on the Seeing Deficiencies test, he must perceive which aspect of a given plan is faulty. One would expect these abilities to be related to cognitive differentiation.

(2) Varimax Two-Factor Rotations

A second Varimax rotation was carried out on the first two factors only using the twenty-four original measures. This was done to increase the size of loadings of some of the tests other than the main ones defining the factors. The results of this rotation are presented in Table 4. When it became apparent that sex and birthorder might well be contributing significantly to variance on both the first and second factors, it was decided to

perform a second two-factor rotation including these two variables. Since the SA Scale - Famous Sayings Test, Preferred Choices, and What-Goes-With-What tests were not loading significantly on either factor following the first two-factor rotation, they were dropped from the second two-factor rotation. Twenty-one variables were thus included in this rotation, which is presented in Table 5.

The effect of these rotations was to markedly increase the loadings of some of the marginally significant measures on factor I. The Associations IV, Gestalt Transformations, Seeing Deficiencies, Inference Test, Groups of Nations, People You Know (#1 and #3), Embedded Figures Test V, ROS - Religious Orientation and ROS - Intrinsic Subscale all reached significant loadings on the first factor (cognitive complexity) in both two-factor rotations. In the first rotation, these measures had loaded on factor 3, which was a complexity factor (differentiation) correlated with factor I. The loadings of the main complexity measures (PCT, TIB, ITI) on factor I remained high after the two-factor analyses, but the differentiation measures were transferred onto this factor with them, thus making it more generally representative of cognitive complexity in terms of the current theory.

Loadings on the second factor (religious rejection) were also increased by the two-factor analyses. The ROS loadings remained relatively high, but the I-E Scale

TABLE 4

TWO-FACTOR VARIMAX ROTATION

	Measure	Factor 1	Factor 2
1.	ITI - Revision #1	.635	-.089
2.	ITI - Revision #2	.673	-.122
3.	Schroder PCT	.817	-.196
4.	PCT - Revision	.795	-.016
5.	Harvey TIB Test	.825	-.103
6.	TIB Test - Revision	.825	-.032
7.	SA Scale - Famous Sayings	.233	-.295
8.	Associations IV	.418	.198
9.	Gestalt Transformations	.402	.015
10.	Seeing Deficiencies	.409	.249
11.	Inference Test	.429	-.034
12.	I-E Scale	-.076	.342
13.	Preferred Choices - LPC	.080	-.015
14.	Preferred Choices - ASo	.114	.174
15.	Groups of Nations	.484	.114
16.	People You Know #1	.427	.546
17.	People You Know #2	.196	.210
18.	People You Know #3	.303	.609
19.	What Goes With What #1	-.017	.081
20.	What Goes With What #2	.073	-.005
21.	Embedded Figures Test V	.332	-.167
22.	ROS*- Religious Orientation	-.236	.790
23.	ROS - Intrinsic Subscale	-.346	.760
24.	ROS - Church Attendance	-.086	.768
	% of common variance	63.4%	36.6%

*ROS = Religious Orientation Scale

TABLE 5

TWO-FACTOR VARIMAX ANALYSIS OF SELECTED MEASURES AND VARIABLES

	Measure	Factor 1	Factor 2
1.	ITI - Revision #1	.660	-.083
2.	ITI - Revision #2	.698	-.108
3.	Schroder PCT	.831	-.122
4.	PCT - Revision	.790	.046
5.	Harvey TIB Test	.834	-.060
6.	TIB Test - Revision	.831	.010
7.	Associations IV	.395	.245
8.	Gestalt Transformations	.361	.186
9.	Seeing Deficiencies	.367	.377
10.	Inference Test	.416	.091
11.	I-E Scale	-.086	.284
12.	Groups of Nations	.471	.184
13.	People You Know #1	.386	.509
14.	People You Know #2	.176	.185
15.	People You Know #3	.260	.559
16.	Sex	-.414	.241
17.	Birth order	.019	.077
18.	Embedded Figures Test V	.335	-.117
19.	ROS - Religious Orientation	-.291	.785
20.	ROS - Intrinsic Subscale	-.405	.768
21.	ROS - Church Attendance	-.136	.771
	% of common variance	64.5%	35.5%

loading, although remaining significant, was slightly reduced. The People-You-Know scores #1 and #3 reached loadings of above .50, which indicates that religiously rejective persons tend to perceive both positive and negative qualities in rated others. The conventionally or intrinsically religious person, on the other hand, is more reluctant to check negative qualities in others, either to enhance his church-reinforced image as a "good" person, or because of religious prohibitions against saying nasty things about others. The EFT V loading on this factor remained slightly negative in both two-factor analyses, but no other measures made a significant appearance on factor 2.

The second two-factor rotation produced a significant sex loading on both factors 1 and 2, but negligible birthorder loadings appeared. A t test between sex means on all the measures, done prior to the factor analysis, revealed that girls were significantly more complex than boys on the ITI, PCT and TIB (see Table 8), and the sex loading on the first factor reflects this difference. On factor 2, boys are significantly more religiously rejective than girls.

(3) Correlations Between Factor Scores and Items

Following the second two-factor rotation, factor scores for all the subjects were obtained using the twenty-one selected variables on factor 1. These factor

scores were then correlated with items from the Tuckman Interpersonal Topical Inventory (revised scoring system #1) and the Schroder Paragraph Completion Test, using the Pearson product-moment method. These correlations are presented in Table 10, Appendix D.

Since a correlation coefficient of approximately .20 is required for significance (using a two-tailed test) at a level of better than .05 with a sample of 109, only those items correlating .20 or above with the factor scores were considered suitable for inclusion in a possible test battery. All of the Schroder PCT items are highly significant, and this test is particularly recommended for use in further studies. Thirteen of the thirty-six items on the Tuckman ITI satisfied the criterion, and these items could easily be administered as a short-form of the ITI.

2. RESULTS OF TESTS OF SIGNIFICANCE BETWEEN MEANS

(1) Birth-Order Means

The differences between means on the complexity measures for first and laterborn subjects were not uniformly in the predicted direction, and failed to reach significance in most cases (Table 6). On both the Schroder PCT and Harvey TIB, firstborns were slightly more complex than laterborns, but on the Groups of Nations test they were significantly (two-tailed $p < .05$) superior.

TABLE 6

MEANS, STANDARD DEVIATIONS AND SIGNIFICANCE OF DIFFERENCES BETWEEN FIRST AND LATERBORN SUBJECTS ON THE TWENTY-FOUR MEASURES USED IN THE STUDY

	Measure	First-borns $\bar{X}_1$	Later-borns $\bar{X}_2$	s_1	s_2	t
1.	ITI - Revision #1	3.72	4.63	7.57	7.70	-0.516
2.	ITI - Revision #2	4.80	7.83	13.00	14.07	-0.953
3.	Schroder PCT	2.32	2.23	0.97	0.93	0.434
4.	PCT - Revision	0.00	-0.51	4.31	4.40	0.509
5.	Harvey TIB Test	2.04	2.02	0.96	0.94	0.075
6.	TIB Test - Revision	-1.64	-2.44	5.61	5.17	0.660
7.	SA Scale - Famous Sayings	22.80	20.80	4.97	5.59	1.596
8.	Associations IV	5.72	6.42	3.55	3.13	-0.938
9.	Gestalt Transformations	8.76	8.12	3.01	3.39	0.842
10.	Seeing Deficiencies	6.84	5.79	2.39	2.29	1.982*
11.	Inference Test	11.04	11.38	2.93	3.52	-0.437
12.	I-E Scale	9.12	9.82	3.30	3.56	-0.870
13.	Preferred Choices - LPC	72.44	69.57	19.72	14.70	0.780
14.	Preferred Choices - ASo	248.24	254.90	167.27	139.39	-0.198
15.	Groups of Nations	8.44	6.36	4.20	3.53	2.450*
16.	People You Know #1	114.64	121.95	38.19	36.30	-0.865
17.	People You Know #2	167.68	197.46	225.33	176.49	-0.686
18.	People You Know #3	15.04	15.88	16.02	13.37	-0.261
19.	What Goes With What #1	36.84	38.55	4.15	4.01	-1.838
20.	What Goes With What #2	7.04	7.75	6.13	7.12	-0.447
21.	Embedded Figures Test V	7.32	6.74	3.98	3.93	0.643
22.	ROS - Religious Orientation	-0.12	-0.23	12.13	9.94	0.044
23.	ROS - Intrinsic Subscale	31.60	30.38	8.45	7.54	0.683
24.	ROS - Church Attendance	4.12	3.85	1.14	1.22	0.994

Note.--df for all tests = 107
*two-tailed $p < .05$

Firstborns were slightly less complex than laterborns on the ITI, but saw significantly ($p < .05$) more deficiencies than laterborns. Surprisingly they were more field independent than laterborns, but were also more acquiescent.

These findings cast doubt upon the value of examining the birth-order variable in relation to cognitive abilities without making a concurrent attempt to identify some of the important training variables which might discriminate between the home environments of first and laterborns. It would be interesting and worthwhile to develop an experimental situation of a Hilton (1967) sort in an effort to specify complexity-inducing or retarding components which differ in firstborn and laterborn training environments, with a view to measuring the interferingness-non-interferingness, structured-permissive, and punitive-unpunishing dimensions which Schroder et al. (1967) and Harvey (1966) regard as critical in complexity training. In the present study, however, the hypothesis that firstborn subjects are of lower cognitive complexity than laterborn subjects must be rejected.

(2) Religious-Orientation Means

In view of Allport and Ross's (1967) confident description of the global, undifferentiated cognitive

style of indiscriminately pro-religious subjects, it was particularly surprising to discover that in this study these subjects were significantly more complex than the other subjects in the sample (Table 7). Indiscriminate pro's were more complex than other subjects on all the main complexity measures, and the difference reached levels of high significance on the Harvey TIB. Indiscriminately pro-religious subjects were significantly (two-tailed $p < .01$) more field independent, and significantly (.001) more internal on the I-E Scale than other subjects. These findings strongly contradict the Allport and Ross based hypothesis that the indiscriminate pro's would exhibit relative cognitive simplicity.

In explanation of these findings, there are a number of salient points to consider. First, Allport and Ross found that intrinsically-religious subjects are less prejudiced than extrinsic subjects. In the present study, the indiscriminate pro's were far more intrinsic ($p < .001$) on the intrinsic subscale of the ROS than were other subjects. Secondly, the Allport and Ross sample consisted of 309 church-going adults (Allport and Ross, 1967, p. 436), which was a very different group from the sample tested in the present study. These subjects were fifteen and sixteen year old adolescents from a wide variety of religious backgrounds. Their responses

TABLE 7

MEANS, STANDARD DEVIATIONS AND SIGNIFICANCE OF DIFFERENCES BETWEEN INDISCRIMINATELY PRO-RELIGIOUS AND OTHER SUBJECTS ON THE TWENTY-FOUR MEASURES USED IN THE STUDY

	Measure	Other $\bar{X}_1$	IPR[1] $\bar{X}_2$	s_1	s_2	t
1.	ITI - Revision #1	4.25	5.44	7.76	7.12	-0.568
2.	ITI - Revision #2	6.69	9.75	13.79	14.18	-0.809
3.	Schroder PCT	2.18	2.63	0.93	0.93	-1.746
4.	PCT - Revision	-0.55	0.50	4.48	3.66	-0.879
5.	Harvey TIB Test	1.92	2.63	0.89	0.99	-2.818**
6.	TIB Test - Revision	-2.94	1.69	4.72	6.54	-3.365***
7.	SA Scale - Famous Sayings	20.83	23.75	5.57	4.44	-1.973*
8.	Associations IV	6.18	6.69	3.21	3.40	-0.570
9.	Gestalt Transformations	8.09	9.31	3.35	2.95	-1.364
10.	Seeing Deficiencies	5.96	6.44	2.35	2.34	-0.749
11.	Inference Test	11.10	12.50	3.34	3.45	-1.529
12.	I-E Scale	10.11	7.06	3.39	3.09	3.329***
13.	Preferred Choices - LPC	70.47	68.81	15.91	16.71	0.379
14.	Preferred Choices - ASo	245.90	296.81	141.77	163.49	-1.284
15.	Groups of Nations	6.68	7.75	3.51	5.06	-1.039
16.	People You Know #1	119.84	122.81	39.22	17.71	-0.295
17.	People You Know #2	199.76	137.56	202.03	58.09	1.212
18.	People You Know #3	16.24	12.50	14.92	5.94	0.979
19.	What Goes With What #1	38.10	38.50	3.99	4.68	-0.360
20.	What Goes With What #2	7.12	10.31	7.01	5.58	-1.715
21.	Embedded Figures Test V	6.43	9.44	3.92	3.00	-2.898**
22.	ROS - Religious Orientation	2.53	-16.06	8.71	3.54	8.337***
23.	ROS - Intrinsic Subscale	32.71	18.75	6.30	3.88	8.506***
24.	ROS - Church Attendance	4.16	2.44	1.07	0.86	6.052***

Note.--df for all tests = 107
***two-tailed $p < .001$
**two-tailed $p < .01$
*two-tailed $p < .05$

[1] IPR = Indiscriminately Pro-religious

to the ROS indicated that many were anti-religious or irreligious (e.g., a written comment on one paper, "I don't believe in this stuff"), which was a category of orientation exlcuded from the Allport and Ross study. Thirdly, it is a well-known principle of developmental cognitive psychology that discrimination, differentiation and related cognitive abilities become more fine with increasing maturation (Werner, 1957; Piaget, 1950; Harvey, 1966). Witkin (1965, p. 332) reports, for example, that in following a group of boys over a 14-year span beginning when they were 10 years of age, there was a significant change in the group as a whole toward greater field-independence and articulation. In an adult sample, therefore, it would be reasonable to expect the intrinsically-religious person to be able to discriminate easily between extrinsically and intrinsically worded ROS items, and to respond differentially. The intrinsic adolescent, however, has probably not differentiated his religious beliefs to the same extent as the intrinsic adult, and would thus affirm his pro-religious orientation in a more generalized way, resulting in categorization as an indiscriminate pro. The indiscriminately pro-religious classification would therefore have considerable validity when used with an adult sample, but less usefulness with adolescents. Clearly the key religious variable involved in this

finding is intrinsicness of orientation, which in this sample related strongly and positively to cognitive complexity.

(3) Sex Means

Sex differences in complexity were not hypothesized in the study because theoretical justification for such a prediction seemed to be lacking. Hunt and Dopyera (1966) found female subjects to be more complex than males, but they did not interpret this result. A routine t test between sex means on all the measures in this study revealed that girls were significantly more complex (two-tailed $p < .001$) on both revised ITI scoring systems, on the Schroder PCT, and on both scoring systems used with the Harvey TIB test. And yet, in line with the often-repeated findings of Witkin et al. (1954), girls were slightly more field dependent on the EFT V than were boys. They were also significantly more pro-religious ($p < .05$) and more intrinsically-religious ($p < .001$) than boys. These findings are given in Table 8.

One plausible explanation of these findings has its roots in the psychology of social-class differences. It must be noted that rural eastern Alberta is an economically-depressed area, and as such, many of the subjects in the sample were very low in socio-economic

TABLE 8

MEANS, STANDARD DEVIATIONS AND SIGNIFICANCE OF DIFFERENCES BETWEEN MALE AND FEMALE S's ON THE TWENTY-FOUR MEASURES USED IN THE STUDY

	Measure	Girls $\bar{X}_1$	Boys $\bar{X}_2$	s_1	s_2	t
1.	ITI - Revision #1	7.35	2.03	7.03	7.35	3.792***
2.	ITI - Revision #2	12.29	2.93	12.99	13.17	3.676***
3.	Schroder PCT	2.61	1.95	0.78	0.96	3.871***
4.	PCT - Revision	0.33	-0.98	3.79	4.73	1.555
5.	Harvey TIB Test	2.37	1.75	0.87	0.91	3.563***
6.	TIB Test - Revision	-0.43	-3.75	5.45	4.64	3.402***
7.	SA Scale - Famous Sayings	21.24	21.27	6.09	5.00	-0.020
8.	Associations IV	6.63	5.95	2.98	3.41	1.089
9.	Gestalt Transformations	7.55	8.85	3.16	3.34	-2.053*
10.	Seeing Deficiencies	5.80	6.22	2.37	2.32	-0.923
11.	Inference Test	11.33	11.28	3.85	2.98	0.065
12.	I-E Scale	9.61	9.70	3.90	3.17	-0.128
13.	Preferred Choices - LPC	70.86	69.72	16.34	15.77	0.366
14.	Preferred Choices - ASo	250.73	255.53	130.35	158.07	-0.169
15.	Groups of Nations	7.22	6.52	3.96	3.63	0.963
16.	People You Know #1	127.16	114.65	33.15	38.76	1.772
17.	People You Know #2	198.33	184.35	175.47	199.54	0.380
18.	People You Know #3	16.31	15.18	14.18	13.88	0.412
19.	What Goes With What #1	38.35	38.00	4.51	3.74	0.435
20.	What Goes With What #2	8.76	6.63	6.98	6.70	1.599
21.	Embedded Figures Test V	6.84	6.90	3.30	4.40	-0.083
22.	ROS - Religious Orientation	-2.71	1.85	10.57	9.96	-2.295*
23.	ROS - Intrinsic Subscale	27.80	33.00	7.38	7.30	-3.651***
24.	ROS - Church Attendance	3.69	4.08	1.26	1.13	-1.681

Note.--df for all tests = 107
*two-tailed $p < .05$
***two-tailed $p < .001$

status. Although no social-class measures were included in the test battery, it would be fair to say that the sample was predominately lower class, with a smattering of subjects in the lower-middle and middle-middle classes.[10] Now it is fairly well established that lower-class children are more aggressive than middle-class children. They typically value qualities such as toughness and successful disobedience, while middle-class children value qualities like cleanliness and obedience (Kvaraceus, 1966). McKee and Leader (1955) found, for example, that lower-class children are in general more aggressive than middle-class children, but that lower-class boys are far more aggressive than middle-class boys. Davis (1943), in an early study, found that the lower-class child is not taught to inhibit aggressive impulses, but that there are fairly strong prohibitions against aggression in middle-class homes. Lower-class fathers, in particular, serve as aggressive and punitive models to their sons (Douvan and Adelson, 1966, p. 326). Douvan and Adelson (1966) report that middle-class parents encourage autonomy and self-reliance in male children far more than do lower-class parents, and that lower-class families continue to use physical punishment with boys even though middle-class homes have

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[10] The author spent the greater part of his boyhood in rural eastern Alberta, and for two years taught in high-schools in that region.

abandoned it. Girls, apparently, are free of many of these restrictions in lower-class homes (ibid., p. 324). The lower-class home, in general, remains more authoritarian than the middle-class home (Kohn and Carroll, 1960).

This set of training conditions has a differential effect on the sexes. "The . . . general point . . . about class analysis is that among adolescents, social class seems to be a more important force in the boy's life than it is for the girls (Douvan and Adelson, 1966, p. 326)." "Girls from both (middle and lower) classes generally approve of their parents' rules; we find no status differences here (ibid., p. 325)." Boys, however, typically rebel against authoritarian punitiveness, and since lower-class boys encounter more such restrictiveness than middle-class boys, they rebel more than middle-class boys (Kvaraceus, 1966). And when rebellion is countered with punitiveness, the immediate response is more rebellion, and the vicious frustration-aggression circle begins (Eron, Banta, Walder and Laulicht, 1961).

Now Harvey (1966) contends that when child rearing practices are "capricious and arbitrary (1966, p. 45)", the child learns to rebel against social authority of all kinds. Rebellion is not a cognitively sophisticated behavior: Harvey classifies it as an attribute of System 2 functioning. Clearly the training environment in many

lower-class homes, with respect to boys, may be regarded as capricious and arbitrary. One would then expect the boys in this sample to respond in a rebellious, rejective way to such authority-loaded middle-class values as religiosity, which they obviously did. The girls in the sample, however, had comparatively little difficulty in accepting such values. Further, in examining male responses to the Schroder PCT stem, "When I am criticized . . .", it became apparent that large numbers of boys were briefly and flatly rejecting the viability and value of criticism. Some rather typical responses to this stem have been included in Table 9. Female subjects, however, did not reject criticism in the same way (or in the same terms) as did the boys. There was in fact an amazing similarity in the wording of the boys' responses to the stem, and the strong conformity-inducing influence of the adolescent male peer group is no doubt responsible. "Boys more often (than girls) hold allegiance to the group as such, conceive the group as a coherent and loyal band offering support to members and having an authority of its own. Boys recognize the 'gang' as a force that could lead a boy to break rules . . . (Douvan and Adelson, 1966, p. 344)."

Possible sex differences in complexity in both urban and rural lower-class areas warrant a psychometrically

TABLE 9

TYPICAL RESPONSES OF MALE SUBJECTS TO THE SCHRODER PARAGRAPH COMPLETION TEST STEM, "WHEN I AM CRITICIZED . . ."

(a). an argument starts. I don't like to be criticized or proved wrong.

(b). unfairly I don't listen.

(c). if it is by a big talking person who doesn't know what he is talking about, I like to give him some of his own medicine.

(d). I just sit back and ignore it. But if the criticism is real bad I would just have to fight for my rights.

(e). by a teacher, I take it, but by a student, I don't listen.

(f). I get mad. When I get mad I criticize.

(g). I dislike that.

(h). I criticize back.

(i). I usually lip off.

(j). I criticize the person right back.

(k). I always criticize back because I love to argue.

(l). I just walk away.

(m). I criticize the person right back again.

(n). When I am criticized I just criticize them right back. Criticizm is the root of all evil.

(o). I take it as a joke which shuts the criticizer up.

sophisticated investigation with a view to establishing the training variables which might account for such differences.

One last note on sex differences: the fact that boys significantly ($p < .05$) excelled girls on Gestalt Transformations may be accounted for by the fact that success on this measure is to some extent a function of mechanical knowledge. Most of the girls in the sample probably had no idea of what a hydraulic brake system is, for example, while the boys were able to answer this particular question with ease. Other questions were similarly biased in favor of the boys.

CHAPTER V

SUMMARY AND CONCLUSIONS

The relationships among a number of postulated measures of cognitive complexity and measures of theoretically based correlates of complexity were investigated in this study, factor analysis being used as the principle method of analysis. The results of the analysis offered tentative support for the main hypothesis of the investigation; namely, that several of the measures would load significantly on a factor representative of cognitive complexity. The normal psychometric approach was used, i.e., the appropriate battery of tests (complexity and correlates) was administered to a chosen sample, the performances of which were intercorrelated and the matrix factor analyzed using the method of principal axes. These factors were then rotated to simple structure by the Varimax method, revealing two factors bearing contents judged representative of complexity and dimensionality. The first two factors were rotated by the Varimax method which had the effect of transferring the dominant loadings onto the complexity factor. This was subsequently used to establish factor scores.

A first step toward the establishment of a test battery to measure complexity was taken by examining the items having significant correlations with the factor

scores. Several of the items correlating highly with the factor scores or criterion seem particularly well suited for further use, possibly for inclusion in a test battery designed to measure the conceptual skills of undergraduate teachers. As Getzels and Jackson (1963) indicate, "relatively little is known concerning the relationship between the cognitive ability of teachers and general demographic variables . . . (1963, p. 571)." That such knowledge is essential is emphasized by Harvey et al. (1968) when they summarize the relationship between cognitive skills and desirable educational outcomes by stating that cognitively-complex teachers

> . . . expressed greater warmth toward children, showed greater perceptiveness of the children's wishes and needs, were more flexible in meeting the interests and needs of the children, were more encouraging of individual responsibility, gave greater encouragement to free expression of feelings, were more encouraging of creativity, . . . invoked unexplained rules less frequently, were less rule oriented, . . . were less punitive and were less anxious about being observed (1968, pp. 151-152).

This further necessitates the precise identification of cognitively-simple teacher trainees by use of a test battery which effectively isolates them. These subjects might then be given treatment to improve their conceptual skills.

A number of important related findings were uncovered in the study. A pattern of rejection of conventional religious practices emerged which was associated with cognitive simplicity, while intrinsicness (sincerity) of religious belief was found to relate to cognitive complexity.

Girls were found to be much more complex than boys, a finding explained on the basis of class-related and sex-related training variables. It was pointed out that this finding is worthy of more detailed investigation since it carries important educational implications.

In general it may be said that the theoretical orientation of Schroder and his co-authors (1967) has significance for education, particularly with regard to its psychometric extension and possible future in shaping training conditions. A large-scale complexity training program involving student teachers is an obvious further step in extending the range of the Schroderian conception of cognitive complexity.

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APPENDIX A

The People-You-Know Test

Name _____

PEOPLE YOU KNOW

Consider the following people you know: yourself, mother, father, the person you dislike most, a friend of the same sex, a friend of the opposite sex, and the person with whom you feel most uncomfortable. Below each of these persons is a list of words which may or may not describe his or her personality. Put a check mark (/) opposite each word which is an accurate description.

This is not a vocabulary test. If you do not know the meaning of a word, ask the supervisor.

YOURSELF

1. sociable	___	3. decisive	___
2. very sociable	___	4. very decisive	___
5. exciteable	___	7. cheerful	___
6. very exciteable	___	8. very cheerful	___
9. responsible	___	11. dependent	___
10. very responsible	___	12. very dependent	___
13. thoughtful of others	___	15. shy	___
14. very thoughtful of others	___	16. very shy	___
17. independent	___	19. trustworthy	___
18. very independent	___	20. very trustworthy	___
21. hesitant	___	23. hard-headed (practical)	___
22. very hesitant	___	24. very hard-headed	___
25. ungenerous	___	27. serious	___
26. very ungenerous	___	28. very serious	___
29. unreliable	___	31. honest	___
30. very unreliable	___	32. very honest	___
33. self-centered	___	35. liked	___
34. very self-centered	___	36. well liked	___
37. frivolous (given to trifling)	___	39. generous	___
38. very frivolous	___	40. very generous	___
41. insincere	___	43. dependable	___
42. very insincere	___	44. very dependable	___
45. unpopular	___	47. altruistic (having regard for others)	___
46. very unpopular	___	48. very altruistic	___
49. imaginative	___	51. inconsiderate	___
50. very imaginative	___	52. very inconsiderate	___

GO ON TO THE NEXT PAGE

MOTHER

1.	sociable	___	3.	decisive	___
2.	very sociable	___	4.	very decisive	___
5.	exciteable	___	7.	cheerful	___
6.	very exciteable	___	8.	very cheerful	___
9.	responsible	___	11.	dependent	___
10.	very responsible	___	12.	very dependent	___
13.	thoughtful of others	___	15.	shy	___
14.	very thoughtful of others	___	16.	very shy	___
17.	independent	___	19.	trustworthy	___
18.	very independent	___	20.	very trustworthy	___
21.	hesitant	___	23.	hard-headed (practical)	___
22.	very hesitant	___	24.	very hard-headed	___
25.	ungenerous	___	27.	serious	___
26.	very ungenerous	___	28.	very serious	___
29.	unreliable	___	31.	honest	___
30.	very unreliable	___	32.	very honest	___
33.	self-centered	___	35.	liked	___
34.	very self-centered	___	36.	well liked	___
37.	frivolous (given to trifling)	___	39.	generous	___
38.	very frivolous	___	40.	very generous	___
41.	insincere	___	43.	dependable	___
42.	very insincere	___	44.	very dependable	___
45.	unpopular	___	47.	altruistic (having regard for others)	___
46.	very unpopular	___	48.	very altruistic	___
49.	imaginative	___	51.	inconsiderate	___
50.	very imaginative	___	52.	very inconsiderate	___

GO ON TO THE NEXT PAGE

FATHER

1.	sociable	___	3.	decisive	___
2.	very sociable	___	4.	very decisive	___
5.	exciteable	___	7.	cheerful	___
6.	very exciteable	___	8.	very cheerful	___
9.	responsible	___	11.	dependent	___
10.	very responsible	___	12.	very dependent	___
13.	thoughtful of others	___	15.	shy	___
14.	very thoughtful of others	___	16.	very shy	___
17.	independent	___	19.	trustworthy	___
18.	very independent	___	20.	very trustworthy	___
21.	hesitant	___	23.	hard-headed (practical)	___
22.	very hesitant	___	24.	very hard-headed	___
25.	ungenerous	___	27.	serious	___
26.	very ungenerous	___	28.	very serious	___
29.	unreliable	___	31.	honest	___
30.	very unreliable	___	32.	very honest	___
33.	self-centered	___	35.	liked	___
34.	very self-centered	___	36.	well liked	___
37.	frivolous (given to trifling)	___	39.	generous	___
38.	very frivolous	___	40.	very generous	___
41.	insincere	___	43.	dependable	___
42.	very insincere	___	44.	very dependable	___
45.	unpopular	___	47.	altruistic (having regard for others)	___
46.	very unpopular	___	48.	very altruistic	___
49.	imaginative	___	51.	inconsiderate	___
50.	very imaginative	___	52.	very inconsiderate	___

GO ON TO THE NEXT PAGE

THE PERSON YOU DISLIKE MOST

1.	sociable	___	3.	decisive	___
2.	very sociable	___	4.	very decisive	___
5.	exciteable	___	7.	cheerful	___
6.	very exciteable	___	8.	very cheerful	___
9.	responsible	___	11.	dependent	___
10.	very responsible	___	12.	very dependent	___
13.	thoughtful of others	___	15.	shy	___
14.	very thoughtful of others	___	16.	very shy	___
17.	independent	___	19.	trustworthy	___
18.	very independent	___	20.	very trustworthy	___
21.	hesitant	___	23.	hard-headed (practical)	___
22.	very hesitant	___	24.	very hard-headed	___
25.	ungenerous	___	27.	serious	___
26.	very ungenerous	___	28.	very serious	___
29.	unreliable	___	31.	honest	___
30.	very unreliable	___	32.	very honest	___
33.	self-centered	___	35.	liked	___
34.	very self-centered	___	36.	well liked	___
37.	frivolous (given to trifling)	___	39.	generous	___
38.	very frivolous	___	40.	very generous	___
41.	insincere	___	43.	dependable	___
42.	very insincere	___	44.	very dependable	___
45.	unpopular	___	47.	altruistic (having regard for others)	___
46.	very unpopular	___	48.	very altruistic	___
49.	imaginative	___	51.	inconsiderate	___
50.	very imaginative	___	52.	very inconsiderate	___

GO ON TO THE NEXT PAGE

A FRIEND OF THE SAME SEX

1.	sociable	___	3.	decisive	___
2.	very sociable	___	4.	very decisive	___
5.	exciteable	___	7.	cheerful	___
6.	very exciteable	___	8.	very cheerful	___
9.	responsible	___	11.	dependent	___
10.	very responsible	___	12.	very dependent	___
13.	thoughtful of others	___	15.	shy	___
14.	very thoughtful of others	___	16.	very shy	___
17.	independent	___	19.	trustworthy	___
18.	very independent	___	20.	very trustworthy	___
21.	hesitant	___	23.	hard-headed (practical)	___
22.	very hesitant	___	24.	very hard-headed	___
25.	ungenerous	___	27.	serious	___
26.	very ungenerous	___	28.	very serious	___
29.	unreliable	___	31.	honest	___
30.	very unreliable	___	32.	very honest	___
33.	self-centered	___	35.	liked	___
34.	very self-centered	___	36.	well liked	___
37.	frivolous (given to trifling)	___	39.	generous	___
38.	very frivolous	___	40.	very generous	___
41.	insincere	___	43.	dependable	___
42.	very insincere	___	44.	very dependable	___
45.	unpopular	___	47.	altruistic (having regard for others)	___
46.	very unpopular	___	48.	very altruistic	___
49.	imaginative	___	51.	inconsiderate	___
50.	very imaginative	___	52.	very inconsiderate	___

GO ON TO THE NEXT PAGE

A FRIEND OF THE OPPOSITE SEX

1. sociable	___	3. decisive	___
2. very sociable	___	4. very decisive	___
5. exciteable	___	7. cheerful	___
6. very exciteable	___	8. very cheerful	___
9. responsible	___	11. dependent	___
10. very responsible	___	12. very dependent	___
13. thoughtful of others	___	15. shy	___
14. very thoughtful of others	___	16. very shy	___
17. independent	___	19. trustworthy	___
18. very independent	___	20. very trustworthy	___
21. hesitant	___	23. hard-headed (practical)	___
22. very hesitant	___	24. very hard-headed	___
25. ungenerous	___	27. serious	___
26. very ungenerous	___	28. very serious	___
29. unreliable	___	31. honest	___
30. very unreliable	___	32. very honest	___
33. self-centered	___	35. liked	___
34. very self-centered	___	36. well liked	___
37. frivolous (given to trifling)	___	39. generous	___
38. very frivolous	___	40. very generous	___
41. insincere	___	43. dependable	___
42. very insincere	___	44. very dependable	___
45. unpopular	___	47. altruistic (having regard for others)	___
46. very unpopular	___	48. very altruistic	___
49. imaginative	___	51. inconsiderate	___
50. very imaginative	___	52. very inconsiderate	___

GO ON TO THE LAST PAGE

THE PERSON WITH WHOM YOU FEEL MOST UNCOMFORTABLE

1.	sociable	___	3.	decisive	___
2.	very sociable	___	4.	very decisive	___
5.	exciteable	___	7.	cheerful	___
6.	very exciteable	___	8.	very cheerful	___
9.	responsible	___	11.	dependent	___
10.	very responsible	___	12.	very dependent	___
13.	thoughtful of others	___	15.	shy	___
14.	very thoughtful of others	___	16.	very shy	___
17.	independent	___	19.	trustworthy	___
18.	very independent	___	20.	very trustworthy	___
21.	hesitant	___	23.	hard-headed (practical)	___
22.	very hesitant	___	24.	very hard-headed	___
25.	ungenerous	___	27.	serious	___
26.	very ungenerous	___	28.	very serious	___
29.	unreliable	___	31.	honest	___
30.	very unreliable	___	32.	very honest	___
33.	self-centered	___	35.	liked	___
34.	very self-centered	___	36.	well liked	___
37.	frivolous (given to trifling)	___	39.	generous	___
38.	very frivolous	___	40.	very generous	___
41.	insincere	___	43.	dependable	___
42.	very insincere	___	44.	very dependable	___
45.	unpopular	___	47.	altruistic (having regard for others)	___
46.	very unpopular	___	48.	very altruistic	___
49.	imaginative	___	51.	inconsiderate	___
50.	very imaginative	___	52.	very inconsiderate	___

APPENDIX B

The What-Goes-With-What Test

Name _____

WHAT GOES WITH WHAT

Below are sets of three words, each of which refers to the behavior of an individual. Each word may be combined with the other words to form a description of an individual's personality. By circling one of the four phrases in the line below the set of three words, you are to estimate the extent to which this description is plausible (believable), i.e., the extent to which this description could apply to a real person.

For example, consider the set of words

KIND----------CONVENTIONAL----------SOCIABLE

Most plausible Plausible Implausible Most implausible

If you can easily imagine a person who is kind, conventional and sociable, then underline the phrase Most plausible. If you find it difficult to imagine such a person, underline Most implausible.

Complete all the items below. If you do not know the meaning of any of the words, ask the supervisor to explain them.

Have you any questions?

---

1. CHEERFUL----------INDOLENT (lazy)----------ENERGETIC

   Most plausible Plausible Implausible Most implausible

2. UNIMAGINATIVE-------IMPRACTICAL----------ENERGETIC

   Most plausible Plausible Implausible Most implausible

3. PLACID (peaceful)---INTELLIGENT----------INCONSIDERATE

   Most plausible Plausible Implausible Most implausible

4. DEPENDENT----------IRRITABLE----------INTELLIGENT

   Most plausible Plausible Implausible Most implausible

5. HONEST----------HOSTILE----------IRRESPONSIBLE

   Most plausible Plausible Implausible Most implausible

6. INTELLIGENT--------INCONSIDERATE----------SUBMISSIVE (Obedient)

   Most plausible Plausible Implausible Most implausible

7. SINCERE----------DISORDERLY----------CONSCIENTIOUS (hard-working)

Most plausible Plausible Implausible Most implausible

8. RESERVED----------IMPULSIVE----------WARM

Most plausible Plausible Implausible Most implausible

9. COLD----------CONSIDERATE----------RELIABLE

Most plausible Plausible Implausible Most implausible

10. HUMOURLESS----------TALKATIVE----------EVEN-TEMPERED

Most plausible Plausible Implausible Most implausible

11. IMAGINATIVE----------COLD----------INTELLIGENT

Most plausible Plausible Implausible Most implausible

12. ENVIOUS----------ALTRUISTIC (having regard for others)----SERIOUS

Most plausible Plausible Implausible Most implausible

13. CRUEL----------SHREWD----------TALKATIVE

Most plausible Plausible Implausible Most implausible

14. INTELLIGENT----------INDUSTRIOUS----------EVASIVE (making excuses)

Most plausible Plausible Implausible Most implausible

15. CRITICAL----------STUBBORN----------IMPULSIVE

Most plausible Plausible Implausible Most implausible

APPENDIX C

Detailed Scoring Key for the Groups of Nations Test

THE GROUPS OF NATIONS TEST
Detailed Scoring Key

I. The subject's total score on the test is the sum of the number-of-groups score and the qualitative-concepts score.

II. The Number-of-Groups Score.

Assign the subject a score of 1 for each valid and distinct grouping he produces. If the groupings overlap, assign them a score of 1. Such a grouping follows:

Nations:	Nations:
Canada	Canada
United States of America	Mexico
Quality:	Quality:
North-American Nations	North-American Nations

These two groupings would be assigned a collective score of 1.

Do not assign a score to groupings which are superficial or supercilious. Groupings such as the following are not valid:

Nations:
Canada
China (mainland)
Czechoslovakia
Quality:
All begin with the letter "c".

III. The Qualitative-Concepts Score.

A. Geographical Concepts. Give the subject a score of 1 if he produces one or more groupings using simple geographical concepts. Give him an additional score of 2 if he produces one or more groupings which utilize unusual or original but valid geographical concepts. (Originality may be regarded as statistical uncommonness of responses (Maltzman, 1960; Anderson, 1966), but the validity of an original grouping must be subjectively evaluated by the scorer)

B. Political, Economic and Cultural Concepts. Give the subject a score of 2 if he produces one or more groupings using political concepts. Valid economic or cultural concepts shall also be assigned a score of 2. If the subject uses an original, meritorious concept falling into any one of these three categories, he shall be assigned an additional score of 3 for that category.

C. Unusual Concepts Falling Into Other Categories. Give the subject a score of 3 if he produces a grouping using an original, meritorious concept which does not fall into any of the previously described categories.

D. Please note that when qualitative-concept points have been awarded for a certain category (e.g., geography), no further points are to be assigned to that category. For example, if the subject produced ten groupings using ten simple geographical concepts, his qualitative-concepts score would be 1.

IV. Some Examples of Commonly-Used Concepts.

A. Geographical Concepts. (Score = 1)

Nations:
- Great Britain
- France
- Poland
- Yugoslavia

Quality:
- European Nations

Nations:
- Canada
- Mexico
- Japan

Quality:
- Mountainous Nations

B. Political Concepts. (Score = 2)

Nations:
- Canada
- Great Britain
- France
- United States of America

Quality:
- Democracies

Nations:
- USSR (Russia)
- Yugoslavia
- Poland
- Germany (East)

Quality:
- Communist Governments

C. Economic Concepts. (Score = 2)

Nations:
Great Britain
Japan
Czechoslovakia
United States of America
Quality:
Industrialized Nations

Nations:
Canada
United States of America
Israel
Union of South Africa
Quality:
Market Economies

D. Social Concepts. (Score = 2)

Nations:
Union of South Africa
United States of America
Great Britain
Quality:
Racial Unrest

Nations:
Canada
Czechoslovakia
USSR (Russia)
Quality:
World Ice-Hockey Powers

APPENDIX D

Correlations Between Factor Scores and Complexity Items

TABLE 10

CORRELATIONS BETWEEN FACTOR SCORES AND COGNITIVE COMPLEXITY ITEMS

Interpersonal Topical Inventory Items

Item No.	r	Item No.	r
1	*137	19	068
2	275	20	117
3	170	21	192
4	-050	22	281
5	001	23	177
6	306	24	162
7	205	25	023
8	-047	26	214
9	-024	27	188
10	180	28	228
11	170	29	121
12	-115	30	172
13	234	31	258
14	142	32	132
15	040	33	285
16	053	34	058
17	230	35	233
18	202	36	267

Schroder PCT Items

Item No.	r
1	521
2	533
3	636
4	676
5	727
6	616

*all decimal places omitted